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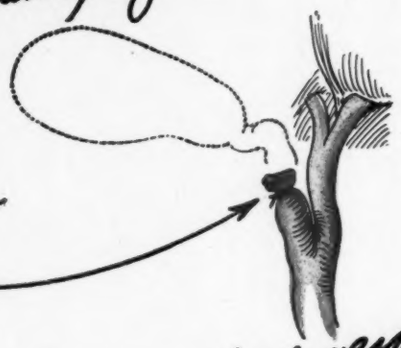

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Editorial

Alchemy and Hope . . . . . *Carl Beck* 1

Original Articles

The Lynch Operation for Carcinoma of the Rectosigmoid . . . . . *Jerome M. Lynch and G. Johnson Hamilton* 3

Carcinoma of the Thyroid Gland in Children . . . . . *Julian A. Rickles* 8

Inguinal Hernia. An Analysis of 2,643 Operations . . . . . *Amos D. Garner* 14

Contents Continued on Page 3

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VOL. LXXIV — Contents • July, 1947 — NUMBER ONE

Fracture Fixation by Transarticular Pin. A Technic for Control of Severe Ankle Fractures . . . . . *M. John Rowe and Ross Sutherland* 24

Cholecystitis and Cholelithiasis in the Young . . . *E. Craig Heringman and David W. Aiken* 27

Convulsions during Inhalation Anesthesia . . . *Theodore L. Hyde and Ray C. Schwegler* 33

The Underdeveloped Chin . . . . . *Lester W. Eisenstodt* 39

Topical Anesthesia. Effect on Tissue Regeneration . . . . . *Frank C. Combes, Morris Reschke and Rose B. Saperstein* 45

Abdominal Symptoms in Sudden Acute Heart Conditions . . . . . *Matthew A. Larkin* 49

Use of Chemotherapy as Possible Means of Reducing Mortality Rate in Perforated Peptic Ulcer . . . . . *John Winslow Hirshfeld, William E. Abbott and Homer Smathers* 54

Anomalous Talocalcaneal Articulation. Cause for Limited Subtalar Movements . . . . . *Lieut. Colonel Charles J. Sutro* 64

Sympathetic Nerve Block in Hypertension and Allied Cases . . . . *Lawrence V. Lindroth* 66

Case Reports

Anterior Thoracic Esophagus . . . . . *Orvar Swenson* 69

Compound Depressed Fractures of the Skull Involving the Superior Longitudinal Sinus . . . . . *Abraham Kaplan* 80

Gallstone Ileus. . . . . *Ted Lace* 86

Torsion of the Spermatic Cord . . . . . *Donald S. Jurnove* 90

Incarceration of the Stomach in an Umbilical Hernia . . . . . *Thomas G. Orr* 96

Acute Traumatic Aneurysm of the Palm . . . . . *John J. Cawley* 98

Uterus Didelphys with Ectopic Tubal Gestation. . . . . *Col. Miles T. Hoerner, Capt. Lawrence H. Wilkinson and Capt. Irwin H. Kaiser* 100

New Instruments

New Principle in Mechanical Abdominal Retraction. . . . . *David J. Wexler* 103

Biopsy Drill Punch . . . . . *Hayes Martin* 107

Bookshelf Browsing

Four Pioneer Architects in Bone. Knight, Taylor, Sayre and Davis . . . . *Edward Podolsky* 109

The Brooklyn Anatomical and Surgical Society . . . . . *Russell Story Fowler* 112

General Information on Page 4 *Advertising Index on 3rd cover*

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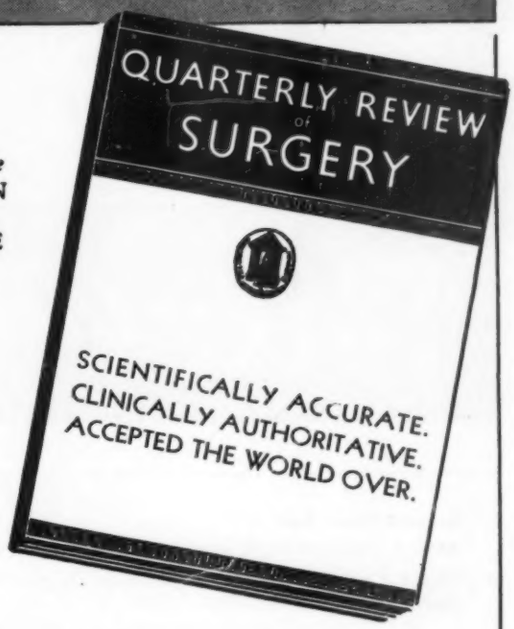

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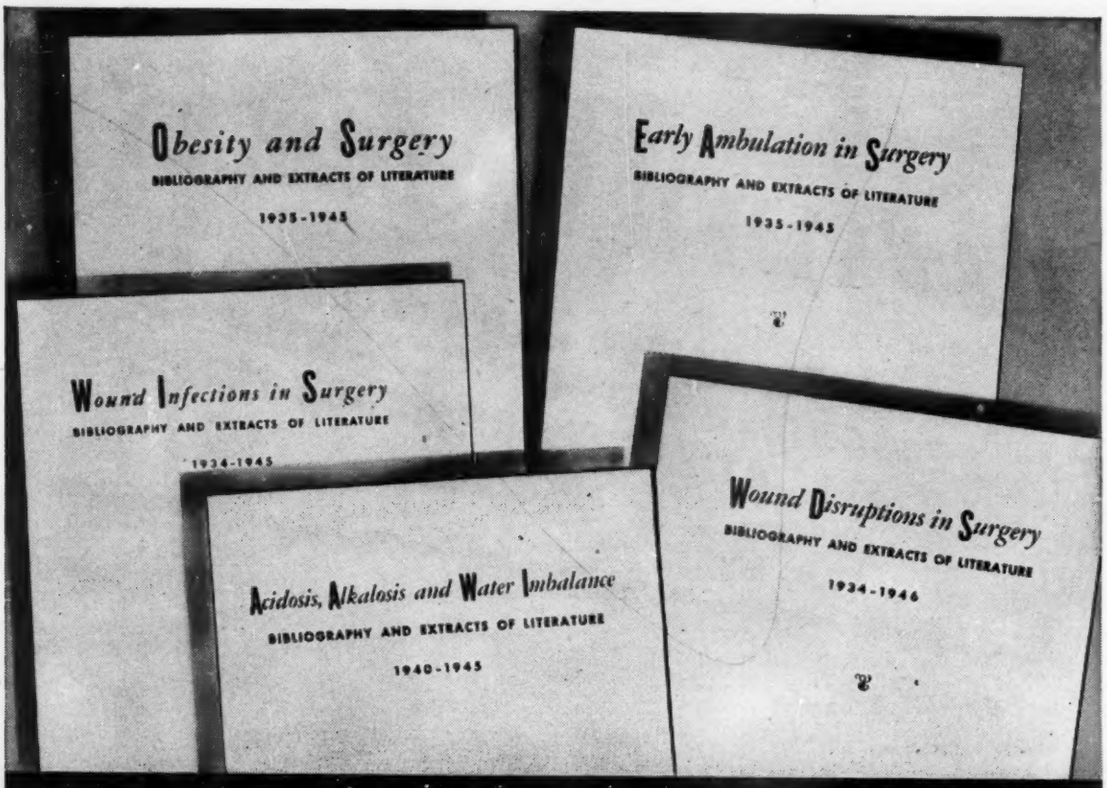

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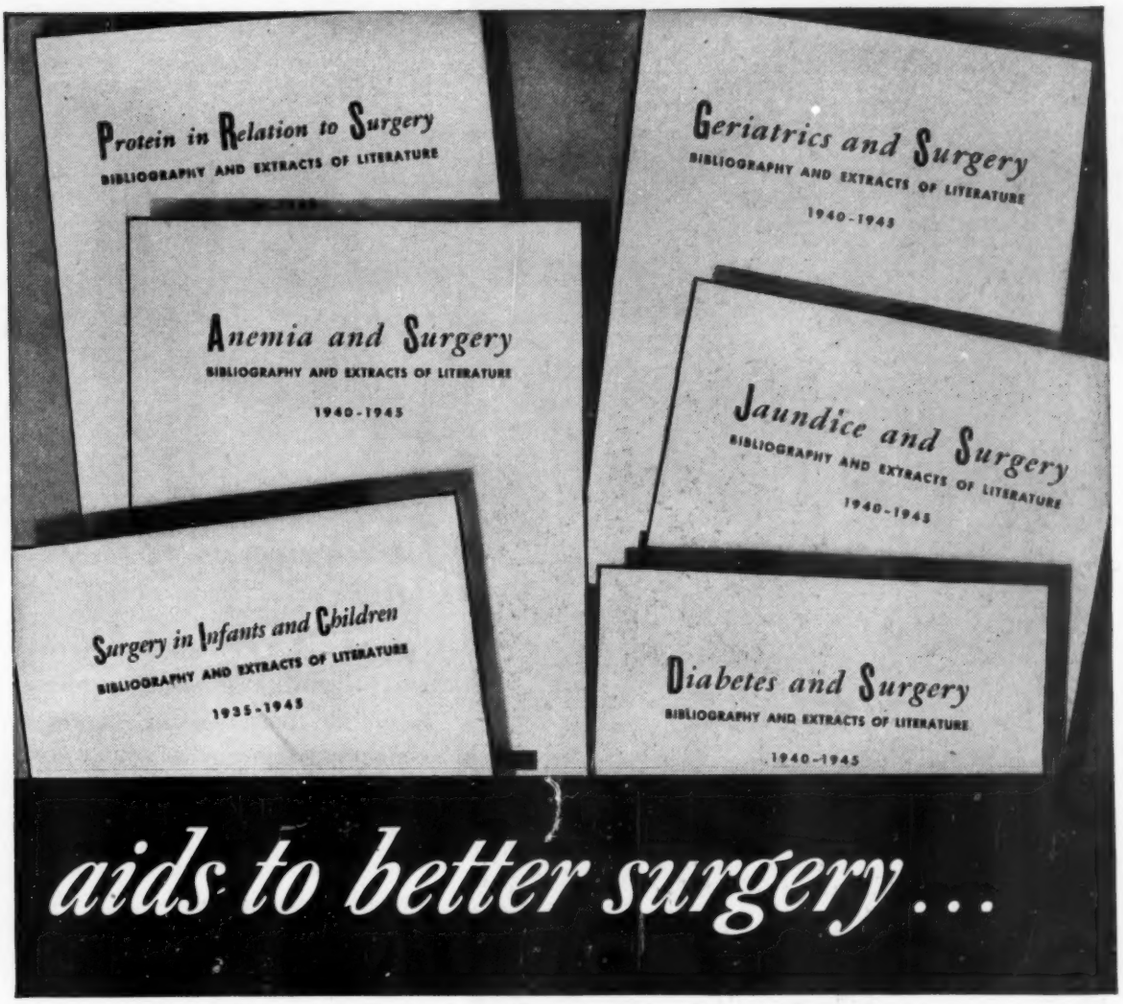

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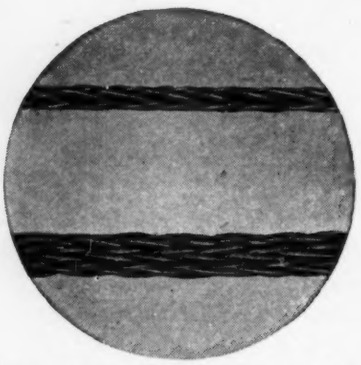

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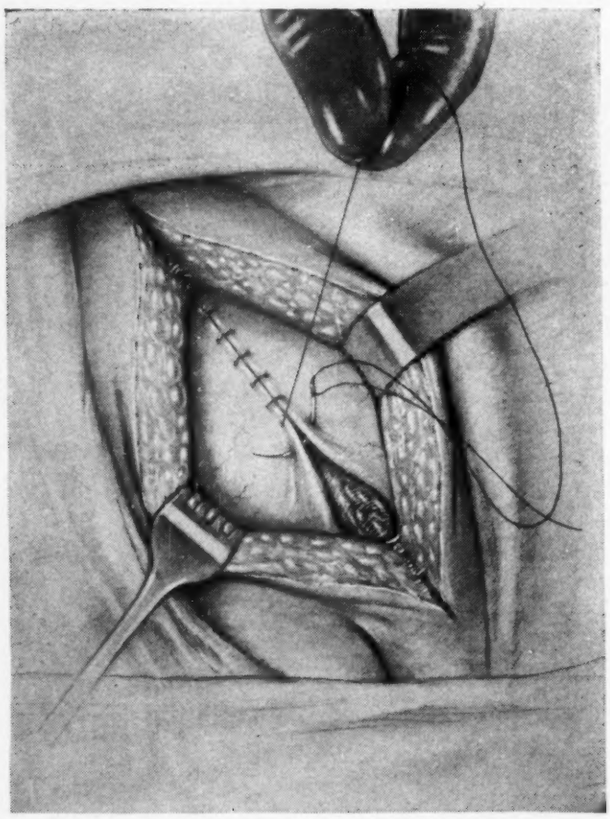

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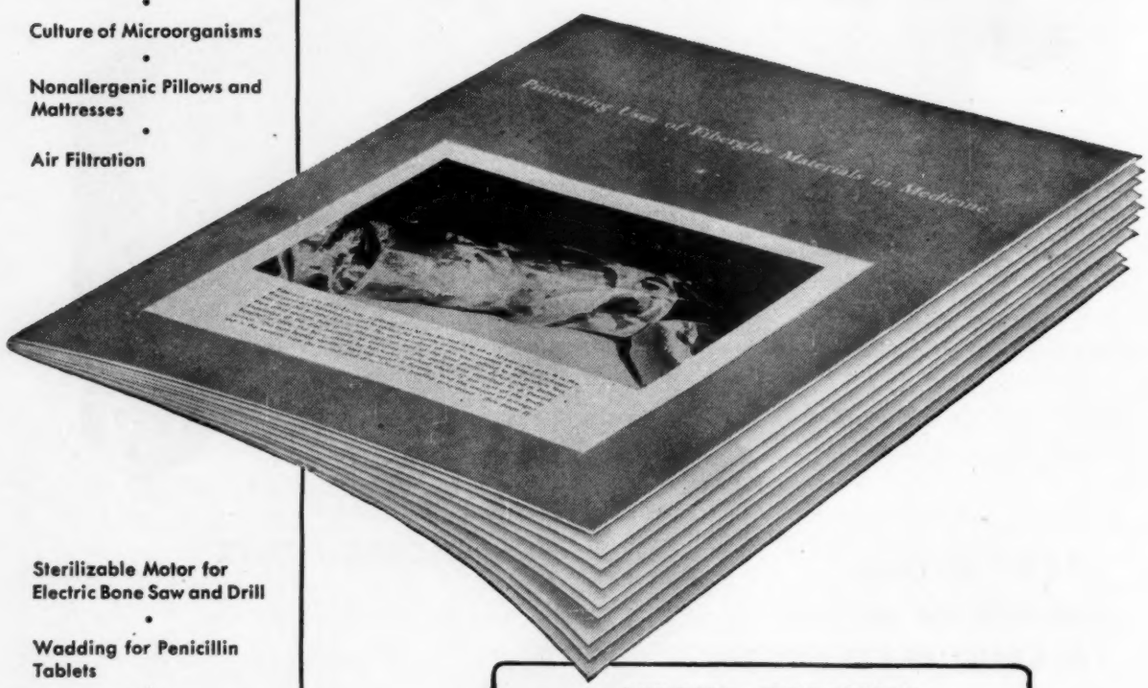

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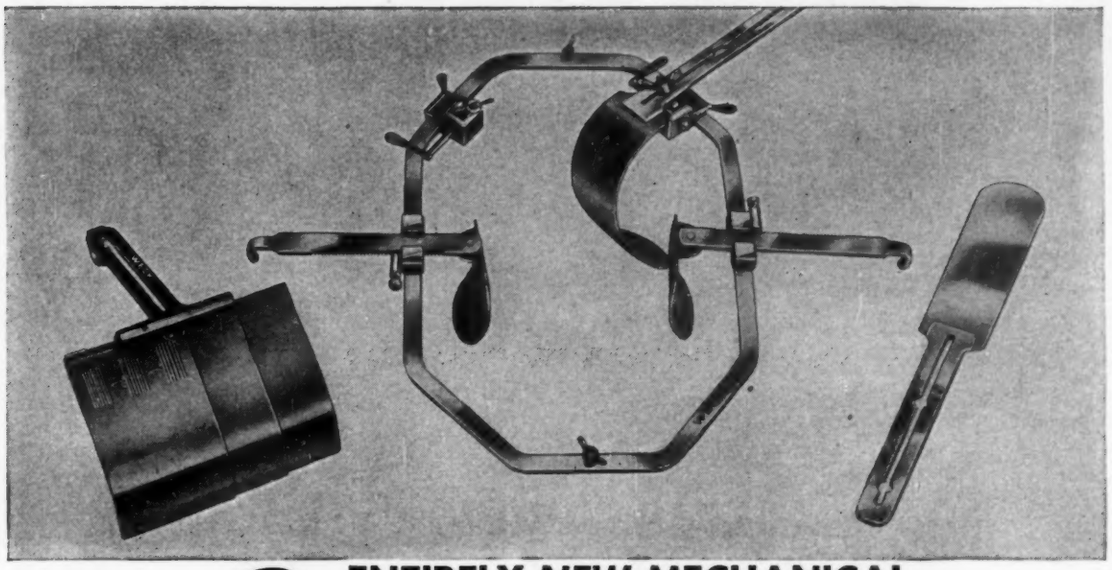

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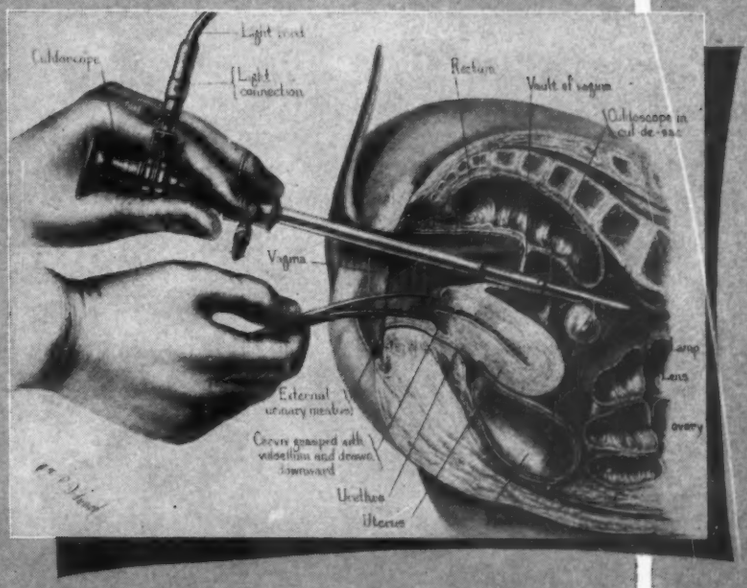

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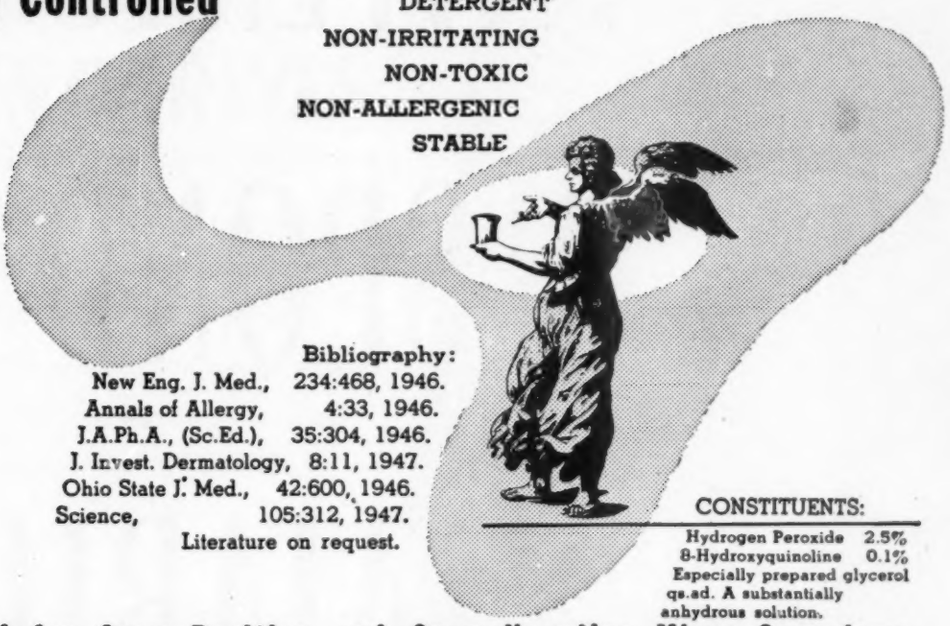

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Literature on request.

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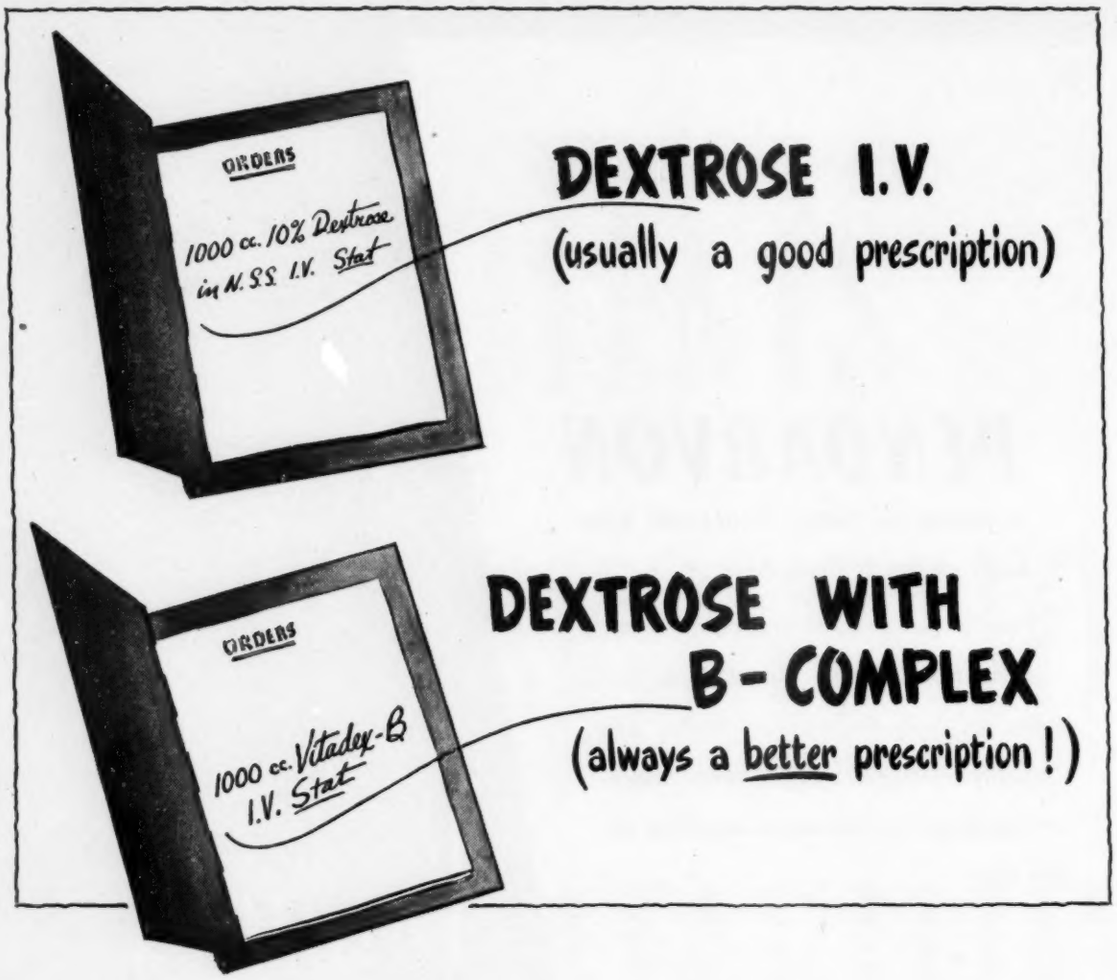

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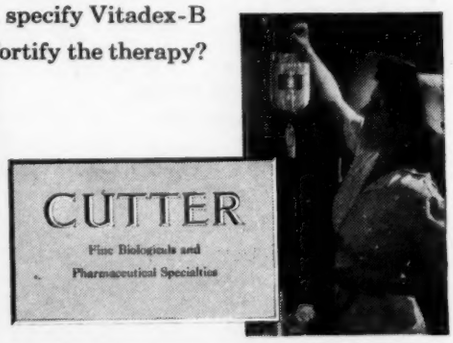
Next time you prescribe "Dextrose I.V.," why not specify Vitadex-B to fortify the therapy?



* *Sebrell, W. H., Jr., et al: J. Pediat. 22: 494-507, April, 1943*

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Protein-Carbohydrate Granules

Protein therapy is important in all branches of medicine. Every cell of every tissue requires protein for growth and repair. Protein requirements are therefore frequently enormous. How may protein be administered in large amounts? The simplest and best way is by mouth, for any patient who can swallow. Infusion hazards are avoided; more complete nutrition is provided.* • 'DELCOS' Protein-Carbohydrate Granules present palatable, concentrated, *whole* protein of high biologic value, protected from wasteful use as energy. • Patients like the taste of 'DELCOS' Granules, and will accept it almost ad libitum. Dosage may be pushed to the limit and maintained at a high level indefinitely. Moreover, since 'DELCOS' Granules provide carbohydrate-protected, *whole* protein, containing *strepogenin*,* a factor lacking in protein hydrolysates and mixed amino acids, maximal nutritional efficiency is achieved. Controlled growth tests have shown that 'DELCOS' Granules are biologically superior to beefsteak. • 'DELCOS' Protein-Carbohydrate Granules contain casein and lactalbumin, providing a balanced combination of *all* the essential amino acids, as *whole protein*, protected from wasteful use as energy by carbohydrate (30%). Supplied in 1-lb. and 5-lb., wide-mouthed jars. Sharp & Dohme, Philadelphia 1, Pa.

*Editorial: J.A.M.A., *131*:826, July 6, 1946.

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IN SLOW-HEALING WOUNDS

Indolent ulcers,
Burns, Infected
Surface wounds,
Non-healing
Lesions

The value of local therapy in chronic skin ulceration lies in speeding up the healing process and thereby shortening the period of disability, and in procuring an end-result which is as nearly normal and free from disfiguration as possible.

To these ends Morruguent and Morumide Ointments lend themselves admirably . . . The active ingredient of Morruguent is cod liver oil concentrate (with a 25% greater content of the unsaponifiable fraction than that contained in cod liver oil U.S.P.). In Morumide, sulfanilamide (10%) has been incorporated, in addition, for its bactericidal action.

Cod liver oil lowers the vitality of pyogenic organisms; sulfanilamide is an active bactericide . . . These preparations prevent or retard infection on an ulcerated surface, reduce systemic absorption of toxic metabolites, hasten granulation and epithelization, and make for a pliable, elastic epithelial surface . . . Healing takes place with a minimum of surface disfiguration.

Morruguent and Morumide Ointments are indicated for topical treatment in chronic indolent ulcers, burns (of any degree), suppurating wounds, non-healing amputation stumps, and similar lesions of the skin.

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Morruguent with
10% Sulfanilamide

When cycles cease at the menopause, Di-Ovocylin relieves the psychosomatic distress that usually follows. A single injection will control symptoms for from 7 to 14 days—far longer than other estrogenic preparations.

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DI-OVOCYLIN (brand of α-estradiol dipropionate). T. M. Reg. U. S. Pat. Off. and Canada.

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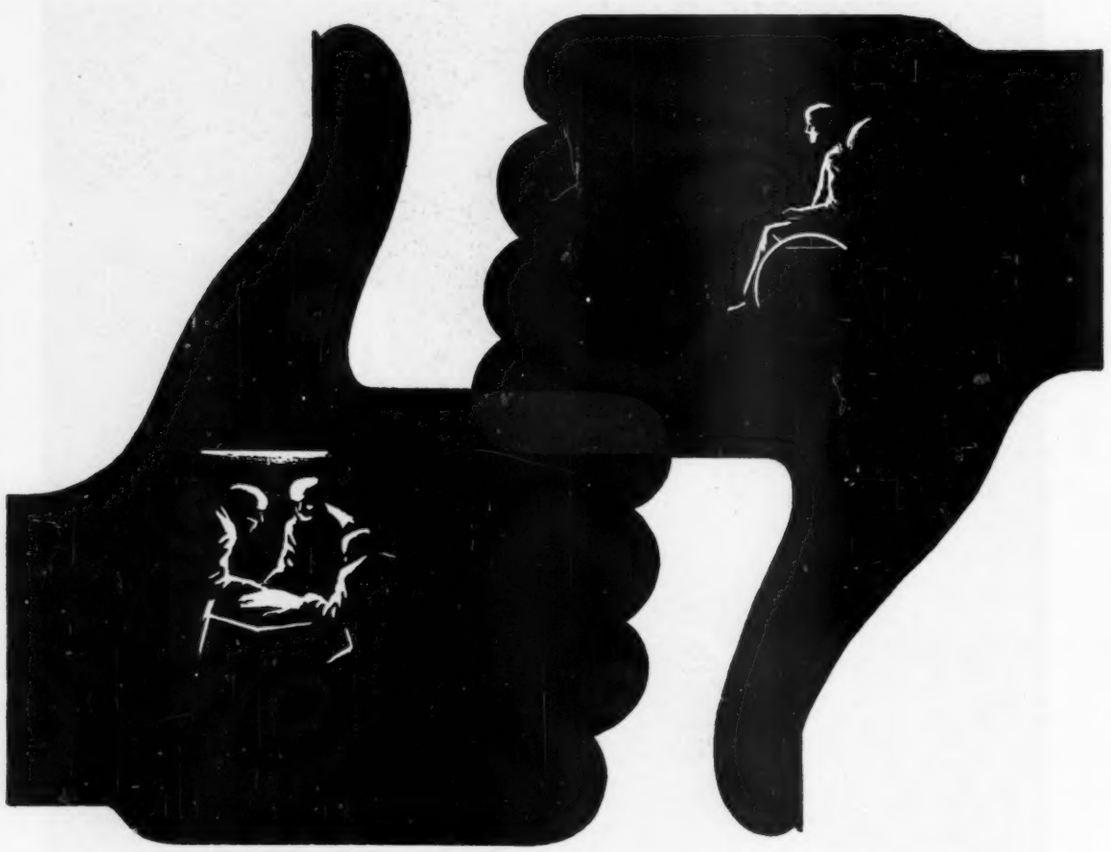
lest the operation be successful...



...but the convalescence a failure

Despite successful surgery, recovery is sometimes prolonged by failure to fortify the patient nutritionally against preoperative, surgical, and postoperative stress. Especially vulnerable to the ordinary demands of these states of stress are the water-soluble C and B factors intimately involved in normal cell metabolism and reparative processes.

Cebēfortis*, as a preoperative precaution and a postoperative aid to healing and convalescence, helps assure adequacy of ascorbic acid and the five major crystalline B complex factors.

EACH CEBĒFORTIS TABLET PROVIDES:

Thiamine Hydrochloride (B_1)	5.0 mg.
Riboflavin (B_2)	5.0 mg.
Pyridoxine Hydrochloride (B_6)	1.5 mg.
Calcium Pantothenate	25.0 mg.
Nicotinic Acid Amide (Nicotinamide)	50.0 mg.
Ascorbic Acid (C)	150.0 mg.

cebēfortis

*Trademark Reg. U. S. Pat. Off.

Recommended daily dose: 2 tablets orally.
Cebēfortis is available in bottles of 100 and 500.

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Ferrous iron in its most agreeable form...

FERGON is Stearns ferrous gluconate...*stabilized* to remain in the ferrous state — generally accepted as the superior form of iron for humans, from the standpoint of absorption as well as toleration. [1, 2]

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STEARNS FERROUS GLUCONATE

For Hypochromic Anemias

THERAPEUTIC APPRAISAL: *Better Tolerated* — Fergon is only slightly ionized, therefore virtually non-astringent, non-irritating... may and should be administered before meals. *Better Absorbed*, Fergon is soluble, and available for absorption, throughout the entire pH range of the gastro-intestinal tract. *Better Utilized*, as shown by comparative clinical studies.[3]

INDICATED in the treatment and prevention of hypochromic anemias; especially valuable in patients intolerant to other forms of iron.

DOSAGE: Average dose for adults is three to six (5 gr.) tablets; for children, one to four (2½ gr.) tablets or one to four teaspoonfuls of elixir daily.

SUPPLIED as 0.325 Gm. (5 gr.) tablets, bottles of 100, 500 and 1000; 0.163 Gm. (2½ gr.) tablets, bottles of 100; 5% elixir, bottles of 6 and 16 fl. oz.

1. Editorial: J. A. M. A. 127:1056, 1945
2. Moore, et al: J. Clin. Investigation 23:547, 1944
3. Reznikoff and Goebel: J. Clin. Investigation 16:547, 1937

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(Sterile Thiopental Sodium, Abbott)

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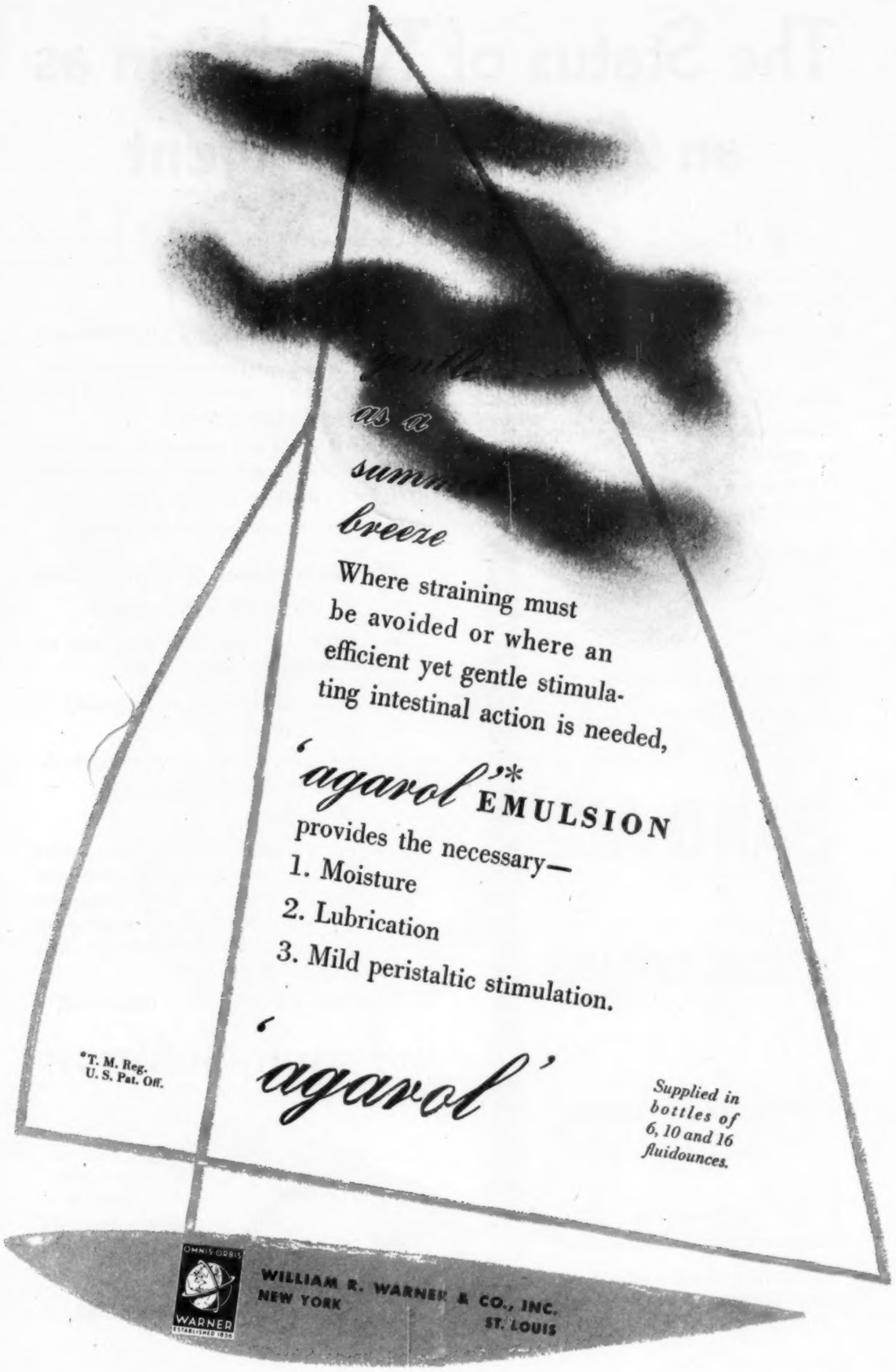

Where straining must be avoided or where an efficient yet gentle stimulating intestinal action is needed,

'agarol'* EMULSION

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1. Moisture
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3. Mild peristaltic stimulation.

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The Origin of Tyrothricin

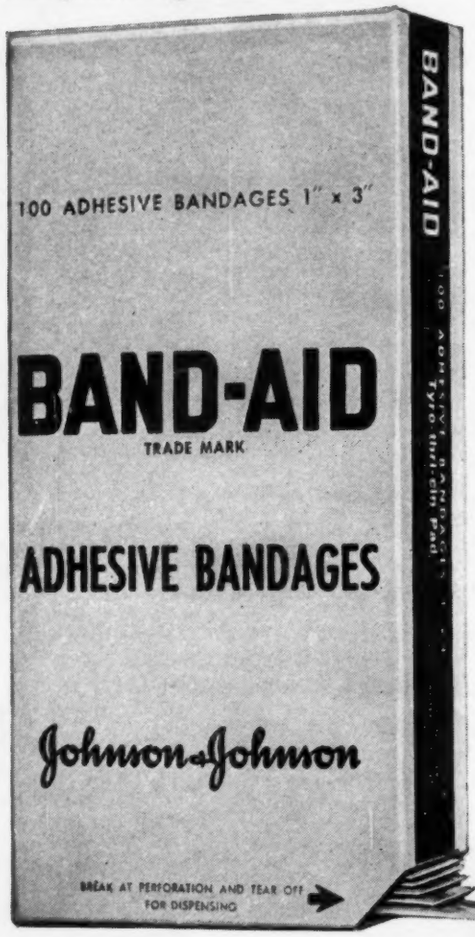
First isolated in 1939 by Rene J. Dubos of Rockefeller Institute.

Recovered from living cultures of the Bacillus brevis.

The Effectiveness of Tyrothricin

Clinically superior to other antiseptic agents for *topical* application.

Highly effective against a wide variety of Gram-positive organisms.



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Used successfully in the treatment, by topical application, of many miscellaneous infectious conditions.

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Broad antibacterial spectrum — more active topically than the sulfonamides—more practical topically than penicillin.

Action is rapid and prolonged — both bacteriostatic and bactericidal. *Activity is maintained in presence of tissue fluids.*

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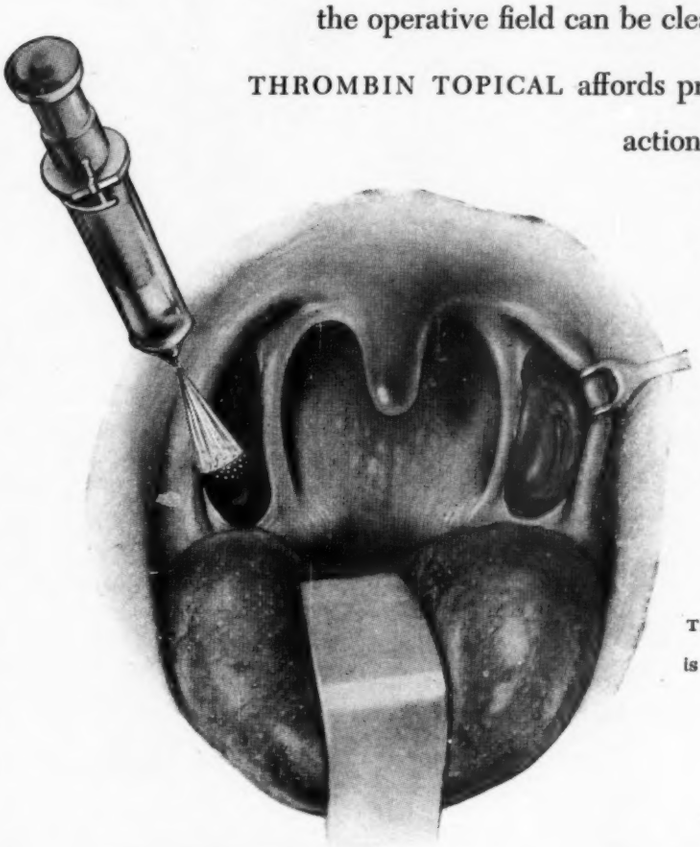
THROMBIN TOPICAL affords prompt, on-the-spot clotting action. It is one of a long line of Parke-Davis preparations whose service to the profession created a dependable symbol of therapeutic significance—MEDICAMENTA VERA.



THROMBIN TOPICAL (Bovine Origin) is available in 5,000-unit ampoules, each packed with a 5 cc. ampoule of sterile, isotonic saline diluent.

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Crystalline Penicillin G Sodium Merck—An Improved, Highly Purified Product

★ No refrigeration required for dry form.

★ Therapeutically inert materials which may act as allergens have been virtually eliminated.

★ Minimum irritation on injection as a result of removal of therapeutically inert materials.

★ Meets exacting Government specifications for Crystalline Penicillin G.

★ Penicillin G has been proved to be a highly effective therapeutic agent.

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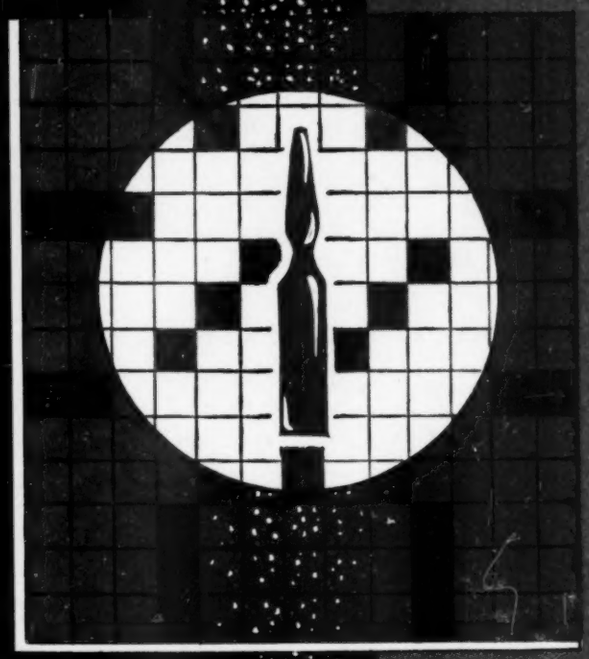
The puzzling

PREMENOPAUSE



The premenopausal years—the late thirties and early forties—are often marred by many symptoms resembling those of the true climacteric. The origin of these symptoms may be obscure, however, because a history of changed menses or "hot flashes" is lacking. In such instances, a therapeutic test with a potent injectable estrogen aids in diagnosis by differentiating between hormonal imbalance and other causes. It is essential, of course, that the estrogen chosen be one which always produces unequivocal improvement whenever estrogen deficit exists.

PROGYNON-B

(alpha-estradiol benzoate)

PROGYNON-B has been proven to be the most desirable injectable estrogen for the premenopausal therapeutic test. Its high and uniform potency assures rapid and complete amelioration of symptoms due to follicular hormone deficiency. Being non-toxic even in the highest therapeutic dosage range, PROGYNON-B will not produce side effects to vitiate clear differential diagnosis or distress the patient.

DOSAGE for therapeutic test: PROGYNON-B, 1.0 mg. (6000 R.U.), injected intramuscularly three times weekly for two weeks. The beneficial effects resulting from a positive test may be continued subsequently by injecting 1.0 mg. (6000 R.U.) or 0.33 mg. (2000 R.U.) once weekly, depending on the individual degree of estrogen deficiency.

PACKAGING: PROGYNON-B is available in ampules of 1 cc. containing 0.08 mg. (500 R.U.), 0.16 mg. (1000 R.U.), 0.33 mg. (2000 R.U.), 1.0 mg. (6000 R.U.) and 1.66 mg. (10,000 R.U.) in boxes of 3, 6, 50 and 100. Vials of 10 cc. (0.166 mg. per cc.) in boxes of 1 and 6.

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Sodium-free Protein Orally

Where increased oral protein intake is necessary for the restoration and maintenance of a *positive nitrogen balance* in the aged, **PROTINAL** is of special value. These intact protein-carbohydrate granules are *sodium-free* and contain all the amino acids necessary to maintain life and growth. Where there is a normal functioning of the gastrointestinal tract, with protein deficiency, **PROTINAL** is indicated.

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Instructor, organizer, surgeon, orator. A founder of the American College of Surgeons. Professor of Gynecology and Abdominal Surgery, University of Tennessee College of Medicine (1899-1912); Professor of Clinical Surgery, Vanderbilt University School of Medicine (1913-1940). President, American College of Surgeons (1933-1934). Major and Lieutenant Colonel, Medical Corps, U. S. Army; Surgeon to Evacuation Hospital, No. 1, Toul, France. Instrumental in organizing the Southern Surgical Association; President (1917).

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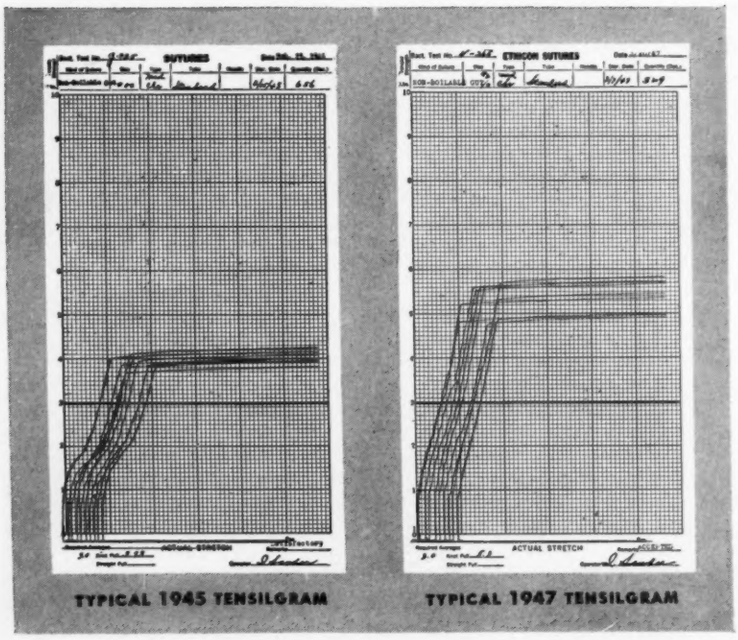


TYPICAL 1945 TENSILGRAM

TYPICAL 1947 TENSILGRAM

● *Here's Graphic Proof of Increased Tensile Strength in Ethicon's New Bonded Catgut.*

These tensilgrams are from actual daily strength tests given each lot of sutures. Horizontal red lines at numeral 3 mark U.S.P. requirements for Knot-Pull strength on Size 00, Non-Boilable Catgut.

Red curves show breaking points in pounds. Up to 30% greater strength and uniformity of strength are strikingly demonstrated. Note close grouping of breaking points.

WHAT EVERY SURGEON WANTS:

Dependable strength when knots are tied

The crucial test of suture strength—just as you tie the knot! Then strain is greatest.

At this stage, efficiency of action is especially important to the smooth performance of the operating team.

A greater margin of safety than ever awaits you in Ethicon's New Bonded Sutures. They are up to 30% stronger than sutures previously produced.

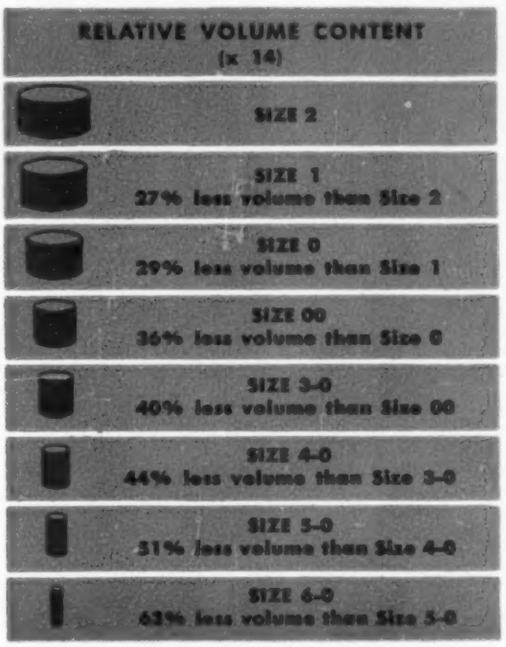
THAT'S WHY YOU CAN USE FINER SIZES WITH CONFIDENCE

LESS TISSUE REACTION ...QUICKER HEALING

Smaller gauges of catgut maintain their integrity longer than larger sizes and arouse less foreign body reaction.

The increased strength of Ethicon Catgut Sutures, up to 60% over U.S.P. requirements, permits you to use smaller sizes—lets you secure all the advantages inherent in decreased volume of suture material.

Ask your hospital to supply you with Ethicon Sutures, and gain all these advantages.



Smaller Volume Reduces Foreign Body Reaction
The above chart shows possible reduction in amounts of suture material embedded in tissue when smaller suture sizes are used.

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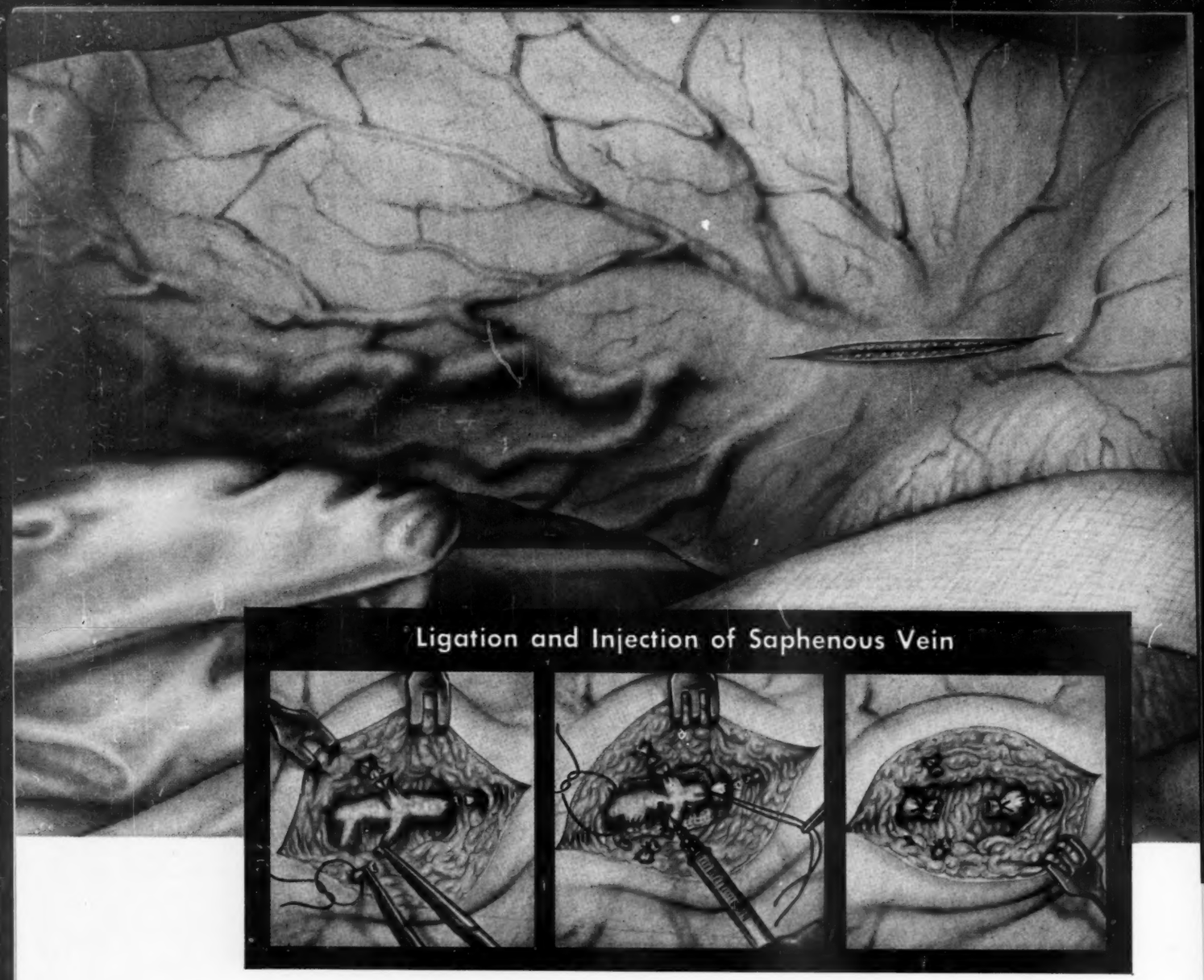
SUPERIOR IN THOSE QUALITIES IMPORTANT TO THE SURGEON



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When meticulous surgery demands

SILK SUTURES

You get more intrinsic tensile strength and minimal tissue reaction with Ethicon's Tru-Formed Black Braided Silk Sutures. They assure you maximal strength and minimal bulk.

Strictly U.S.P. gauge. Non-capillary. Serum-proof. Non-toxic. Forms smooth, firm knots. Superior handling qualities.

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Division of Johnson & Johnson, New Brunswick, N. J.

World's Largest Manufacturer of Surgical Gut

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A PRACTICAL JOURNAL BUILT ON MERIT

Fifty-sixth Year of Continuous Publication

VOL. LXXIV JULY, 1947 NUMBER SEVEN

Editorial

ALCHEMY AND HOPE

IN the early centuries of the Christian era certain Greeks in Alexandria began experiments with metals in the hope that they could transform them from the baser ones to precious material. With avarice as their stimulus, they devoted their lives to this work. By apprentice training and by the written word their experiences, their technics and their results were passed on to succeeding generations. With unflinching hope of ultimate success, men expended their lives in this process, hoping to find the Philosophers' Stone, whose power would be so great that it could accomplish their purpose of conferring certain desired quantities to elements so as to change their physical characteristics.

The work of the alchemists was not easy. Often it was carried out in the face of derision of the populace. At other times, it is true, it was carried out under the protectorship and even the subsidy of the reigning monarch. Some, as the kings of Bohemia, placed the alchemists workshops in the compounds of their palaces, and encouraged their efforts. They did not put their faith in the miraculous or supernatural; they ascribed their efforts to an imitation of nature.

It is interesting to note that they worked with, or attempted to achieve, slight differences from natural elements; for example, they needed sulfur that was not quite sulfur, but some principle which was derived from it—the philosophers' elixir or stone.

Now, after almost twenty centuries of effort, the goal has been attained. The transmutation of elements is now a reality. The philosophers' stone has been found. The terminology is a bit changed; the transmutation of the elements is now called a chain reaction. The philosophers' stone is now called an atomic pile, and the sulfur which is not quite sulfur is called an isotope. Hope, added to the undying efforts of man, sponsored by individuals, by monarchs, by states and then by an Allied High Command and two billion dollars has resulted in the fulfillment of the dream of those Alexandrian Greeks in the first centuries of our era.

In the sixteenth century, Paracelsus diverted alchemy to the field of medicine. He believed that the purpose of the alchemist should be for the benefit of the ill rather than the manufacture of gold. Today we need another Paracelsus who would divert the products of their dreams to the benefit of man rather than to their destruction. But we also need more of the alchemists' hope, hope that the many barren wastes of our knowledge of the cause and cure of disease will be penetrated by the

processes of research. We must eschew the derision of the dreamers who propose the fantastic. We must aid their adventures into the field of science. We must enlist the aid of monarchs and states, seek their sponsorship, so that we, who now battle somewhat picayunishly against the ravages of cancer, heart disease and so many human ills, will not have to hope for an answer for centuries. Let us turn our hope into active effort.

Let us not make the mistake of housing our modern alchemists in hovels. Let us make our scientists into the most respected members of the community. Let us lure the ambitious into the fields of research. The alchemist sought to find a way of making gold, but, life is far more precious than gold. Nevertheless, let us pave the way with more of the precious metal, so that the road of the scientist shall not altogether be a drab and difficult one. And let us, more than anything else, inoculate him with the hope of the alchemist.

Carl Beck, M.D.

The cause of metastasis is not known. There are many factors involved, such as the richness of the blood and lymph supply, the frequency of freeing cells into the vessels, pressure of the tumor, fibrosis and encapsulation, size of the growth, and injury of the tissues.

From "Metastases Medical and Surgical" by Malford W. Thewlis (Charlotte Medical Press).

Original Articles

THE LYNCH OPERATION FOR CARCINOMA OF THE RECTOSIGMOID

JEROME M. LYNCH, M.D. AND G. JOHNSON HAMILTON, M.D.
NEW YORK, NEW YORK

THIS technic was first employed in 1935. It is designed for those cases in which the tumor is too low to permit removal by anterior resection and anastomosis. It showed so much promise that a preliminary report was published in the *American Journal of Surgery* in June, 1937. At that time it was stated that shock was so much diminished as to increase the operability rate greatly. The hope was expressed that this benefit was achieved without any decrease in the salvage rate. It was emphasized that only time could prove whether or not this was so. The answer to this question is now presented in an analysis and follow-up of the first fifty cases submitted to this technic.

During the period under consideration sixty-five patients were seen with carcinoma at or about the rectosigmoid junction. Eleven of these refused operation or went to other surgeons. Four were considered inoperable because of carcinomatosis. Fifty were operated on by the Lynch technic. This series was composed of twenty-nine males and twenty-one females. Broder's method of classification revealed two grade one, forty-seven grade two and one grade three. Analysis by Duke's method revealed one grade A, twenty-one grade B and twenty-eight grade C.

OPERATIVE TECHNIC

Since there have been many small but helpful changes in the technic as first published, it will be described in full. The operation is usually performed under low spinal anesthesia, but the responsibility for the choice of anesthesa is always delegated to the anesthetist. The patient is placed in the exaggerated Trendelenburg position with the buttocks protruding beyond the edge of the table and with a sandbag under the sacrum. This permits easy access to the sacrococcygeal joint. The area is cleaned with 10 per cent tannic acid in alcohol. In the male, a large silk woven or gum elastic catheter is introduced into the bladder and fastened *in situ*. A purse-string suture of heavy silk is placed about the anus. Incisions are made from the tuber-ischii to the sacrococcygeal joint.

The coccyx is excised, preserving the few attachments of the levator ani to the sacrum. These attachments and the rectum are freed from the hollow of the sacrum by blunt dissection. The resulting cavity is filled with a hot pack.

The incisions at the tuber-ischi are continued anteriorally to meet in the perineum at the base of the scrotum or just behind the vagina. These incisions are deepened until the plane of cleavage between prostate and rectum or vagina and rectum is defined. These structures are then separated by blunt dissection.

The packing is removed from the hollow of the sacrum. The levators and lateral ligaments of the rectum are defined and divided between the clamps as laterally as possible. The rectum is now free and the peritoneal reflection is visible and may be incised. In a few cases, the specimen to be removed is short enough so that the peritoneum need not be opened but merely stripped off the sigmoid much as a banana

is peeled. Once the peritoneal cavity has been opened a loop of sigmoid will prolapse. Crushing clamps are applied at the optimum point above the tumor. The inferior mesenteric artery or its branches are ligated in such a manner as to preserve the blood supply to the point of severance of the sigmoid. The bowel is then divided between crushing clamps with the actual cautery. The crushing clamp is removed. A rather soft rubber tube 2 cm. in diameter is inserted into the bowel and secured with a suture. The wound is inspected to ensure hemostasis. The peritoneum is not closed unless there is prolapse of the small bowel in which event the prolapse is controlled with a few interrupted sutures. The wound is packed with gauze soaked in 10 per cent tannic acid in alcohol. This packing is kept moist with the same solution and

TABLE I

OPERATIVE DEATHS

Case No.	Age	Sex	Cm. from Anal Verge	Classification		Cm. of Specimen	Cause of Death
				Broder	Duke		
5904	40	F	10	3	C	34	Ascending infection of urinary tract; mors tenth postoperative day
7219	41	M	8	2	C	41	Paralytic ileus; mors sixth postoperative day
5428	57	M	3	2	C	18	Paralytic ileus; hiccoughs for 11 days; mors thirteenth postoperative day
6026	66	M	10	2	C	35	Ascending infection of urinary tract; hypostatic pneumonia; mors twenty-fifth postoperative day
7085	70	F	5	2	C	25	Surgical shock; mors twenty-five hours postoperatively

TABLE II

RECURRENCES

Case No.	Age	Sex	Cm. from Anal Verge	Classification		Cm. of Specimen	Recurrence Discovered	Site of Recurrence	Died
				Broder	Duke				
6028	27	M	7	2	C	22	6 mo.	local	10 mo.
6069	38	F	15	2	C	41	11 mo.	local	Reoperated
7042	42	M	11	2	C	48	11 mo.	local	12 mo.
5605	42	M	7	2	C	18	6 yr.	spine	6½ yr.
7006B	45	M	8	2	C	31	2 mo.	local	4 mo.
5842	49	M	5	1	B	40	8 yr.	liver	8 yr. 1 mo.
5848	51	F	5	2	C	50	2 mo.	general	6 mo.
6061	53	M	5 and 8 (double)	2	C	28	19 mo.	local	Reoperated
5676	53	M	1	1	C	30	in-operable	local	Reoperated
5759	58	F	2	2	B	15	2 yr.	local	Reoperated
5516	63	F	2	2	C	22	18 mo.	local	21 mo.
7019	63	M	2	2	C	35	1 yr.	local	18 mo.
5585	65	F	10	2	B	21	3 yr.	local	3 yr. 6 mo.
7048	67	F	5 and 10 (double)	2	C	28	5 mo.	local	8 mo.
7205	69	F	10	2	B	26	16 mo.	local	24 mo.
5829	69	M	7	2	B	21	14 mo.	general	16 mo.

removed in forty-eight hours together with the flatus tube. From that time on, the wound is sprayed several times a day with this solution contained in an atomizer. The bowels are moved by means of magnesium sulfate given at the time that the flatus tube and packing are removed. No other digressions are made from the present established methods of pre- and postoperative care.

TABLE III

NON-ATTRIBUTABLE DEATHS

Case No.	Age	Sex	Cm. from Anal Verge	Classification		Cm. of Specimen	Comments
				Broder	Duke		
7038	50	F	5 and 8 (double)	2	C	70	Pneumonia 6 years postoperatively
6061	53	M	5 and 8 (double)	2	C	28	Pulmonary tuberculosis; 4 years postoperatively
6060	66	M	5	2	B	28	Suicide two years postoperatively to provide insurance for wife
5647	68	F	1 and 8 (double)	2	B	12	Pneumonia 2 years postoperatively
5892	73	M	5	2	B	15	Suicide 4 years postoperatively; senile dementia
7006A	80	M	4	2	B	20	Pneumonia 2 months postoperatively

ANALYSIS OF CASES

There were five operative deaths in this series. Familiarity with the technic, improved team work within the institutions, and the great advances in pre- and postoperative care should greatly decrease this operative mortality. Even if this were not so, it is believed that the high operability rate would justify a somewhat higher operative mortality. (Table I.) It is believed that the first four of these cases could probably have been saved if the present methods of pre- and postoperative care had been available.

RECURRENCES

It is the rule for local recurrences to predominate in all types of operation for cancer at or about the rectosigmoid. A study of 500 of our patients operated upon by the combined methods revealed that 70 per cent of the recurrences were local. This technic is no exception. Despite the removal of almost all the soft tissue in the pelvis, all but three of the recurrences were local. One dreads to think of the fate in store for those subjected to the "muscle-saving" operations. (Table II.) It is to be noted that two of these were double lesions and seven of them were within 5 cm. of the anal verge. Four of them were deemed suitable for reoperation and are described more fully.

Reoperations. Case No. 6069 (Table II) underwent a hysterectomy seven months after the excision of her rectosigmoid. At this time no evidence of carcinoma was discovered. Nevertheless, four months later a local recurrence was found and the patient was reoperated upon. She succumbed twenty months later to a generalized carcinomatosis. Case No. 6061 (Table II) was discovered to have a local recurrence nineteen months after resection of the rectosigmoid. A second operation was performed, but the patient died four years later of pulmonary tuberculosis which existed prior to the first operation. A complete autopsy showed no evidence of carcinoma. Case No. 5676 (Table II) was found to have envolvement of the prostate

and urethra. On three different occasions he developed a perforation of the urethra which was repaired by sliding grafts of carcinomatous tissue. He died of carcinomatosis four years after the first operation. In the interim he carried on his profession as a lawyer except for the above mentioned three periods of hospitalization. Case No. 5759 (Table II) was discovered to have a local recurrence two years after resection of the rectosigmoid. She was reoperated upon but succumbed to carcinomatosis one year later. (Table III.)

FATE UNKNOWN

It is to be regretted that in this, as in every series a certain number of patients disappeared from our ken. That this group is so large, is due to frequent moves of patients and doctors, as well as to the disruption of routine inherrent in the war years. (Table IV.)

TABLE IV

FATE UNKNOWN

Case No.	Age	Sex	Cm. from Anal Verge	Classification		Cm. of Specimen	Known to Be Alive and Well
				Broder	Duke		
7193	48	F	12	2	B	45	2 yr. and 8 mo. postoperatively
5998	55	M	10	2	C	39	9 mo. postoperatively
7023	60	F	8	1	A	42	3 yr. and 9 mo. postoperatively
6022	66	M	5	2	C	31	3 yr. and 6 mo. postoperatively
7160	69	F	7	2	B	38	1 yr. postoperatively
5614	70	M	2	2	B	20	2 yr. and 6 mo. postoperatively
7101	71	M	3	2	B	25	2 yr. and 1 mo. postoperatively

TABLE V

SALVAGED

Case No.	Age	Sex	Cm. from Anal Verge	Classification		Cm. of Specimen	Alive and Well
				Broder	Duke		
6015	31	F	7	2	C	25	6 yr. 1 mo.
5605	42	M	7	2	C	18	Died 6 yr. 6 mo.
6032	48	F	14	2	C	51	8 yr.
5876	43	M	8	2	C	35	9 yr.
5895	49	M	10	2	B	33	7 yr. 10 mo.
5842	49	M	5	1	B	40	Died 7 yr. 11 mo.
7038	50	F	5 and 10 (double)	2	C	70	Died 6 yr.
5612	52	M	7	2	B	30	10 yr. 5 mo.
7213	52	M	8	2	C	28	6 yr. 2 mo.
clinic	57	M	3	2	C	18	7 yr. 1 mo.
7060	58	F	9	2	B	40	7 yr. 5 mo.
5963	59	M	8	2	B	18	8 yr. 5 mo.
6068A	60	M	8	2	B	25	7 yr. 9 mo.
7295	61	M	7	2	C	30	6 yr. 1 mo.
5883	62	M	5	2	B	25	9 yr. 11 mo.
5539	65	F	5	2	C	21	10 yr. 10 mo.
5519	65	F	2	2	B	20	11 yr. 5 mo.
5732	72	F	7	2	B	23	9 yr. 9 mo.

SALVAGED

Under this category, only those patients are included who were alive and well at least five years postoperatively. (Table v.)

SUMMARY

An attempt has been made to analyze the first fifty cases submitted to the Lynch technic and to follow up those patients to the present time. All relevant facts have been included, and the reader has been permitted to compile his own statistics.

The series was composed of twenty-nine males and twenty-one females; classified according to Broder's system, there were two grade one, forty-seven grade two and one grade three. According to Duke's system, there were one grade A, twenty-one grade B and twenty-eight grade C.

The operative technic has been described.

The pre- and postoperative care has been omitted except where this technic calls for departure from the normal.

CONCLUSIONS

It is believed that this technic greatly increased the operability rate without unduly increasing the operative mortality, and it is shown that the salvage rate is very high despite the high proportion of older patients and poor operative risks.

THE most frequent benign growth in the sigmoid or the rectum is the solitary adenoma. The squamous papillo-fibroma (squamous polyp) resulting from hypertrophy of an anal papilla is also quite common. All other benign neoplasms are of infrequent occurrence in this region.

From "Ambulatory Proctology" by Alfred J. Cantor (Paul B. Hoeber, Inc.).

CARCINOMA OF THE THYROID GLAND IN CHILDREN*

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CARCINOMA of the thyroid gland is a relatively rare tumor. Schreiner and Murphy give an incidence of 0.37 per cent of 11,212 malignancies recorded at the New York State Institute for the Study of Malignant Diseases.[1] Operations for malignancies of the thyroid occupied 1.03 per cent of thyroidectomies performed at the Mayo Clinic between 1907 and 1928.[2] At the Lahey Clinic the incidence of primary malignancies of the thyroid was 1.7 per cent, and six of 258 cases occurred in patients under fourteen years of age—an incidence of 2.3 per cent—although two of these were in aberrant thyroid tissue.[3] It has been generally accepted that the general incidence of carcinoma of the thyroid in children is less than 1 per cent of the total incidence of the disease; however, the ratio of malignant to non-malignant diseases of the thyroid is about the same in children as in adults.[4]

Pathologically, epithelial tumors of the thyroid in children tend to follow the same cellular pattern as in adults and are most commonly found in a solitary adenoma of the gland. Warren's classification to these tumors is one of the most workable and one of the most generally accepted. It is as follows:

Group I (1) Fetal adenoma with blood vessel invasion
(2) Papillary adenocystoma with blood vessel invasion

Group II Adenocarcinoma
(1) Papillary
(2) Alveolar

Group III (1) Diffuse small cell carcinoma
(2) Small compact cell carcinoma
(3) Giant cell carcinoma
(4) Fibrosarcoma

Most of the tumors in Group I and II are those that develop in a solitary adenoma; they represent the slower growing tumors. In Group I the diagnosis of malignancy rests on finding blood vessel invasion. In Group II there is invasion of the tissues surrounding the adenoma, the papillary type being the more benign—these tumors usually spread via the lymphatics but these are the group that metastasize to bone. Group III are the most highly malignant and are the type that is frequently found in aberrant thyroid tissue. They are the hardest to diagnose early in the disease.

A very useful clinical classification includes those which develop within a thyroid nodule and those which are diffuse in one or more lobes of the gland; the first type being the most benign, the easiest to suspect and cure. Three of the following four cases fall into this group.

Reports in the literature are not frequent. Hughes[5] reported a case of a thirteen year old girl with metastatic glands who was well three months after operation. Schultz[6] records a case in a girl five and one-half years old. Moncrieff and Poynton[7] record the autopsy findings in a girl aged eleven. Pemberton and Dixon[2] present two cases under nine years of age and eight more under nineteen (but it may be that sarcomas were also included in this group). Hare[3] reports six cases, three of which had previously been reported by Cattel;[8] two of these cases were in aberrant thyroid tissue and one was in a thyroglossal duct cyst. Kennedy[4] reports eight cases from the Mayo Clinic ranging between seven and fourteen years of age seen between 1909 and 1934. Only two of his cases were in a previously existing adenoma. Other reports by Lee,[9] Berard,[10] Meleney[11] and Taylor and Wilkinson[12] all concern patients under twenty years of age.

* From the Department of Independent Surgery, Charity Hospital, New Orleans, La.

The following case reports are of interest because they represent a fairly large series in this disease and all four were seen in Charity Hospital within a period of only two years. They are also interesting because carcinoma of the thyroid in adults is much less frequently seen here than in the North despite the high incidence of adenomatous goiter seen at this hospital. The ages range between six years (seventy-two months) and eleven years.

CASE REPORTS

Case 1. A. F., a healthy eight and one-half year old girl, entered Charity Hospital September 28, 1942, for removal of a lump in the neck, noted and growing steadily since the age of three. In the past two years it grew more rapidly and attempts at treatment had been made. For most of this time she was treated with various medicines, some containing iodine. For three months she had been getting larger doses of iodine which did not affect the growth of the lump. For two days before admission she had a maculopapular rash scattered over body but not the extremities, with itching and excoriated skin. Physical examination was negative except for the skin and neck. Her blood pressure was 110/60, pulse 90, respirations 25, temperature 98.6°F. The neck showed a slightly tender non-fluctuant mass about 5 by 4 by 3 cm. lying underneath and not attached to the right sternomastoid nor to the tissues of the neck. It moved with swallowing and seemed to be separate from the thyroid. Peripheral blood count, blood chemistry and urine analysis were essentially normal. Vocal chords were normal.

She was taken to surgery on October 12th. An adematous mass was found well separated from the remaining thyroid tissue by its capsule and attached to the medial portion of the right lobe of the thyroid. It was completely removed. The pathological report stated that the mass was 6 by 4 by 3.4 cm. and weighed 40 Gm. Diagnosis: Malignant adenoma of the thyroid with undifferentiated cells and invasion of the blood vessels. Her postoperative course was uneventful. A roentgenogram of her chest January 28, 1943, showed no evidence of metastasis. She has remained free of symptoms to the present time according to the social worker's report.

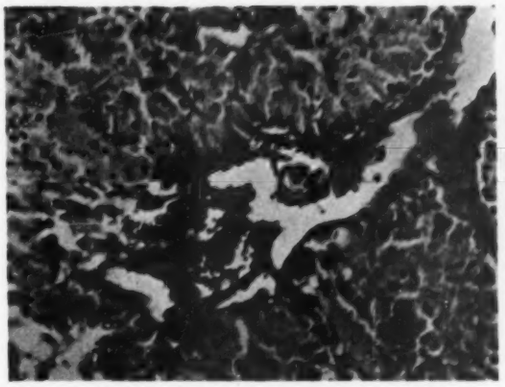

Fig. 1. Case 1. Shows numerous large undifferentiated tumor cells, especially at the lower margin and tumor invasion of the blood vessel in the center of the field. High power × 600.

Case 11. G. M., an eleven year old white female, was admitted to Charity Hospital on January 27, 1943, with the diagnosis of hypothyroidism. It was noted in October, 1941, at a clinic examination that the child was obviously mentally and physically retarded. A history obtained at that time showed that she had always been retarded and did not walk or talk until after two years of age. Her basal metabolic rate at that time showed a minus 36 per cent with all other signs of hypothyroidism. She was started on thyroid and was built up to 3 gr. daily. Her condition improved and she became more alert and more energetic but in August, 1942, a nodular enlargement of her thyroid was noted and Lugol's solution was given. In October, 1942, she was again placed on thyroid gr. ½ three times a day. She showed little improvement and the nodule remained. Psychiatric examination showed a mentally retarded child.

She was admitted to the pediatric ward at which time her work-up pointed to hypothyroidism. A biopsy of the thyroid nodule was advised by surgery. This was done on February 23rd at which time the entire right lobe was removed. This was reported as papillary adenocystoma of low grade malignancy. Her condition was satisfactory and on the basis of the pathological report a total thyroidectomy was advised and performed on March 9th. The right lobe had been completely removed at the previous operation. All of the remaining thyroid tissue was removed at this time. The pathologist found a 2 mm. nodule on this side with blood vessel invasion,

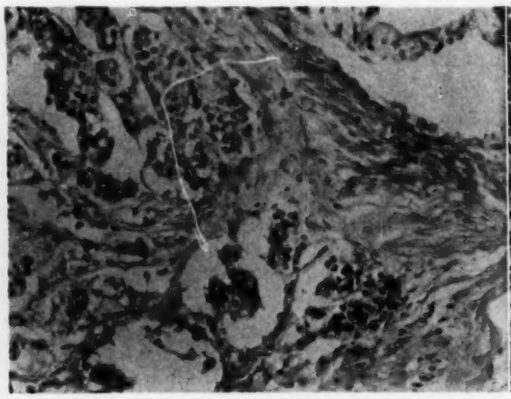

FIG. 2. Case II. Shows undifferentiated tumor cells in the dense fibrous stroma of the otherwise atrophic gland. × 200.

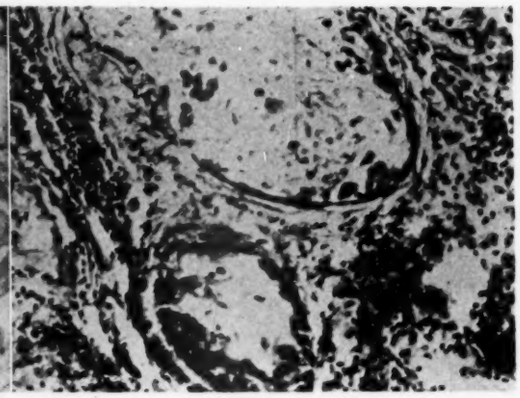

FIG. 3. Case II. Marked hypoplasia of the thyroid acini present. Some tumor cells can be seen at the bottom of this section. × 200.

presenting the same microscopic picture as found on the right side. Her postoperative course was good. She was given 3 gr. thyroid daily and later cut down to 1. She was readmitted on November 16, 1943, to see how well stabilized she was. A complete laboratory work-up showed normal basal metabolism rate and all other laboratory tests were within normal limits. The November 19, 1943, chest plate was negative. Her mental status has not improved but she has no evidence of recurrence of metastases at the present time.

CASE III. J. M., a ten year old white female, was admitted to Charity Hospital on January 27, 1943, with her sister for observation of a mass in the neck. The swelling developed slowly and was of about fifteen months' duration. The child was a mild cretin type, smaller than a girl her age should be. There was a palpable nodule in the right lobe of her thyroid. She was started on thyroid extract by her local physician but this was discontinued in favor of Lugol's solution on October 8, 1942. October 30, 1942, thyroid gr. ¼ three times a day was again started. The gland became smaller but the nodule persisted. She walked at eighteen months and talked at two and one-half years of age. The basal metabolic rate on October 7, 1942, was −17 per cent. Repeated on February 4, 1943, it was −8 per cent. The blood chemistry work-up was essentially normal. Bone *x*-rays on November 12, 1942, revealed epiphyseal development of a child five years of age. On February 1, 1943, carpal *x*-rays showed normal development. Skull plates were normal. Psychiatric examination showed normal mental development. Venous pressure was 83.0.

She was physically retarded but had always gotten along all right in school. Biopsy of the nodule on March 16, 1943, showed slight fibrosis with a typical epithelial hyperplasia which microscopically was practically identical with that seen in her sister's thyroid. She was taken to surgery on March 16, 1943, and a total thyroidectomy was performed. The report was—"Multiple nodules of fetal adenoma. This tumor although not definitely invasive in the sections studied should probably be considered malignant. The remaining gland shows slight atrophy and atypical hyperplasia of the epithelium. Cellular structure very similar to that seen in the patient's sister." She was put on gr. 1 thyroid daily and the postoperative course was uneventful. She was readmitted May 10, 1943, August 9, 1943 and November 14, 1943. Her condition was good, the mental development excellent and all blood chemistry studies were normal. Basal metabolic rate normal with the patient on gr. 1 thyroid daily. No evidence of recurrence at the present time.

CASE IV. J. B., a five year eleven month old boy, first entered Charity Hospital May 26, 1941, at the age of two with a complaint of hoarseness; he could never speak above a whisper. He had a cold at the age of four months but no inflammation of the upper respiratory tract since. He now was having increasing difficulties with breathing and after crying he would almost stop breathing. The physical examination was essentially normal. A laryngoscope was used on June 6, 1941, and multiple polyps of the larynx were seen. On June 9, 1941, a tracheotomy was performed and on June 16, 1941, the polyps were removed

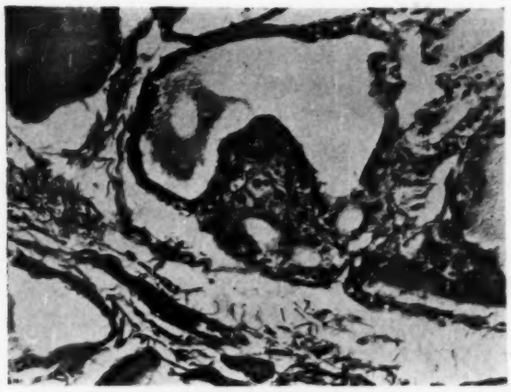

Fig. 4. Case III. Shows tumor nodule in center joining with the hypoplastic thyroid tissue. On the extreme right hand side of this section blood vessel invasion can be seen. × 200.

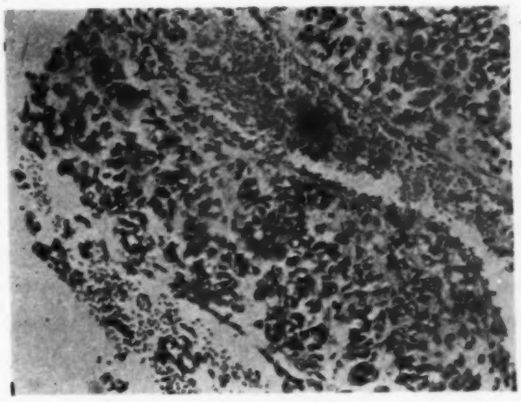

Fig. 5. Case IV. Diffuse carcinomatous involvement of the entire gland. Shows numerous tumor cells in the blood vessel at the lower left. × 200.

with a snare and the bases cauterized with silver. The pathological diagnosis was squamous papilloma with no evidence of malignancy or a specific etiological agent. The laryngoscope was again used on July 7, 1941, and there was no evidence of any polyps although a note was made that very little of the vocal chords were left. He was discharged on July 11, 1941, and followed in the Ear, Nose and Throat Clinic. The laryngoscopic results on August 25, 1941, were normal.

He was again readmitted to the Ear, Nose and Throat wards on August 5, 1944, with a complaint of difficulty in breathing as well as hoarseness. The respiratory difficulty had been increasing in the last six months. Physical examination showed a small occipital abscess and an enlargement of all the lymph nodes in the posterior half of the neck. He could not speak above a whisper. There were several nodules palpable on each side of the trachea which were interpreted as lymph nodes. The thyroid was not enlarged. The remainder of the physical examination was normal. His respiratory difficulties became worse and on August 7, 1944, another low tracheotomy was performed. A small lymph node removed at this time was sent to the pathology department. The patient became much better and on August 21, 1944, he was laryngoscoped and several small papillomas were removed. These were also reported as benign. The lymph node which was removed at the time of the tracheotomy was reported as a metastatic carcinoma of the thyroid gland to a lymph node and he was transferred to surgery. On September 8, 1944, under endotracheal anesthesia a total thyroidectomy was performed. All regional lymph nodes were removed also at this time. Only one parathyroid was adherent to the tumor and this was removed. There was some difficulty removing the gland from the trachea to which it was very adherent. The entire left lobe and a small part of the right lobe were infiltrated by the tumor. Several small lymph nodes were found near the gland and were also removed. The pathological report was adenocarcinoma of the thyroid with metastases to the parathyroid gland and then to the adjacent lymph nodes. His postoperative course was excellent except for temporary hypothyroidism which cleared up when his dosage of thyroid was increased to 5 gr. daily. The tracheotomy was discontinued on September 13, 1944, and on September 25, 1944, deep ray therapy was begun. He was given a 4,598 R. total skin dose through each of two portals over a period of thirty-five days. There has been no evidence of a recurrence at the present time. He is still on 5 gr. thyroid daily with no ill effects from this much drug. There is no evidence of recurrence or metastases at the present time.

COMMENTS

Case I is interesting from the point that the patient is apparently free of disease three years later after undergoing only a simple excision of the adenoma which had been present most of her life. This stresses the point that the only difference between a benign and a malignant adenoma of the thyroid is the finding of the vascular inva-

sion in the microscopic examination of the tissue.

Cases II and III have several interesting features; in the first place the tumors occurred in sisters; secondly they were practically identical microscopically and thirdly both girls had definite evidence of hypothyroidism, the older of the two unfortunately was allowed to become a cretin before medical aid was sought. It is especially interesting to note that in Case II a small (not palpable) nodule from the opposite lobe also showed malignancy and if the policy of simple excision of the presenting nodule were followed cancerous tissue would have been left in the gland. All three of the above patients were treated by surgery alone and none have yet shown any evidence of recurrence; despite this the author believes that the second and third patients should have had deep *x*-ray therapy postoperatively as children stand *x*-ray therapy very well, and over a long series of patients more cures will be obtained by giving postoperative irradition. (*X*-ray therapy was not thought to be indicated by our *x*-ray department at that time.)

Case IV illustrates the difficulty of making a clinical diagnosis on the diffuse type of malignancy. Because of his laryngeal pathological condition this child was very carefully followed in the hospital and clinics since the age of two, and at no time did physical examination of the thyroid region give any hint of a pathological disorder in the gland; the diagnosis was made only by microscopic examination of a metastatic node which was grossly normal. His response to surgery and *x*-ray were excellent and despite the metastases to the local nodes and parathyroid gland there is no evidence of recurrence at the present time.

DIAGNOSIS

The diagnosis of these tumors is completely a pathological one and it is only when the disease is hopelessly beyond cure that we can be certain of a clinical diagnosis of carcinoma of the thyroid. These four cases illustrate that if treated promptly these patients have an excellent outlook. It is only by removing all solitary nodules of the thyroid and subjecting them to careful pathological study that early diagnosis of malignancy can be made and cures can be secured, regardless of the age of the patient or the duration of the disease.[13] The difficulty of making an early diagnosis in the diffuse type of growth is obvious as they present no symptoms and physical examination of the gland is normal—as was seen in our Case IV, the diagnosis was made quite by accident and even by that time local metastases were present. In Taylor and Wilkinson's patient all attention was paid to the pulmonary symptoms which were thought to be inflammatory and it was only at autopsy that the real pathological condition was discovered.

TREATMENT

The treatment of these patients depends upon the pathological disturbance present. If, as was seen in Case I, there is a well encapsulated nodule which is easily separated from the rest of the gland and the rest of the gland is normal, simple excision of the nodule with a small margin of normal thyroid tissue should result in a cure. If any of the local lymph nodes are involved these should also be removed and intensive postoperative irradiation should be given. In the patient who presents a deep-seated nodule which is not well encapsulated even though it can be readily separated, a frozen section should be made on the removed lobe and if the nodule is malignant a total thyroidectomy should be performed; this should be followed by intensive postoperative irradiation. There is considerable difference of opinion on the above statement and many men would only remove the presenting nodule; however, as was seen in Case II there may be another small malignant focus somewhere else in the gland that is not apparent at the time of operation. Frequently, a positive diagnosis cannot be made by frozen section and unless the diagnosis is certain paraffin

sections should be obtained before the entire thyroid is removed; this procedure was followed in Cases II and III. In Kennedy's[4] series the author believes that the indication for total thyroidectomy is definitely shown, as two of his eight patients had local recurrences after subtotal removal of glands of low grade malignancy, and there is reason to believe that a third subject in the eight cases would prove to have a recurrence if a biopsy of the nodules in his neck were performed. Since thyroid extract is easily available and low in price the author sees no reason for risking recurrences by being conservative in the removal of these growths. Both Cases III and IV of the present series are showing full normal development on oral thyroid extract.

In a diffuse growth, without metastases distant to the neck, a total thyroidectomy with removal of all local lymph nodes and any other tissue that is involved by the tumor (i.e., parathyroid as was present in Case IV) should be done and this should be followed by intensive postoperative irradiation as soon as skin sutures are removed. Some authors believe in doing a radical neck dissection in these cases, however, with improved radiological technics this is probably not necessary. If, however, the lymph nodes of the neck are grossly involved by the tumor and there is no evidence of distance metastases, a radical neck dissection will probably give the higher percentage of cures. However, our radical attacks to this disease are still so new that it is not definitely known whether radical surgery will result in more cures than a simple removal of the gland followed by intensive postoperative *x*-ray therapy by the newer technics. The author believes that in the obvious presence of multiple metastases to the lymph nodes of the neck a radical neck dissection combined with deep ray therapy will result in more cures than depending on *x*-ray alone to sterilize the involved glands. In patients with distant metastases the procedure depends primarily upon the condition of the patient. In a patient in good condition the author believes that removal of the gland followed by postoperative irradiation will result in prolongation of life as well as comfort and certainly will prevent later obstructive symptoms from occurring. In poor risk patients with widespread disease, of course, palliation is all that can be done.

SUMMARY

Four cases of carcinoma of the thyroid in children between the ages of six and eleven are presented followed by a discussion of the diagnosis and treatment. Photomicrographs of the tumors are shown.

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INGUINAL HERNIA

AN ANALYSIS OF 2,643 OPERATIONS

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ONE of the problems most frequently encountered by the general surgeon, now as in years past, is that of how to treat a patient with an inguinal hernia so that he may be allowed an early return to a gainful occupation with the least possible chance of recurrence. The challenge to the surgeon's judgment, ingenuity and skill is no less great today than it was a century ago, though remarkable progress has been made in recent years toward arriving at a better understanding of the anatomy of the inguinal region and the measures necessary for the cure of hernia. Differences in anatomical concepts, operative technics, suture materials and preoperative and postoperative care have been credited with the varying successes or failures of surgeons throughout the years. Older and more experienced men are wont to emphasize the personal equation in accounting for the differences in statistical results in contrasted series of cases. The more inexperienced among us are inclined to seize and hasten to apply any new development that may be introduced in the field of reparative surgery in an attempt to eliminate whatever fault is believed to be responsible for previous failures. The last word has not as yet been said in regard to the cause of failure in hernia repair for recurrence is still common. However, the general consensus is that recurrence, with few exceptions is the result of error on the part of the surgeon in selecting the proper type of operative procedure to be employed in the repair of a particular type of hernia or in his application of surgical principles in effecting the repair. Much has been said both for and against the various standard hernia operations with the variations and modifications of each including the use of many kinds of suture materials. But, in our opinion, the operative procedure and suture material to be employed should be adapted to the type of hernia to be repaired rather than *vice versa*.

No attempt will be made here to trace the stages in the development of the various operations presently used in the treatment of hernia. The types of hernias encountered in this series are described and classified and the various operations used in their repair are explained in detail. The criteria for the use of each operation are enumerated. The 2,643 hernia repair operations upon 2,040 patients summarized in Tables I to V represent the total number of hernias repaired in the U. S. Veterans Administration Hospital in Dayton Ohio, in the years 1934 to 1944 inclusive. The patients were all male veterans, twenty-two to seventy-nine years of age. Sixty-five per cent of these men were admitted for operation during the fifth decade of their lives. The average age for the group is 47.3 years. Fifty-five per cent of the hernias were on the right side, with 45 per cent on the left side. Thirty per cent of the patients had bilateral inguinal hernias. Eighty-four per cent of the total number of cases have been followed from one to ten years. In the course of follow-up, 61 per cent were examined on one or more occasions by a physician, usually one of our staff. Twenty-three per cent of our follow-up reports were received in reply to routine questionnaires which are sent out from the hospital every twelve months to those patients who have not returned for examination within a year after discharge. On 423 or 16 per cent of the cases in the series we have no follow-up records. Almost all of these latter patients were operated on in the years 1939 to 1944, a period of tremendous population migration and all attempts to contact them have been unsuccessful to date. Perhaps more of them will report back to us in later years and further follow-up studies may be possible. Eighty-four per

cent of all patients were followed one to five years; 16 per cent were followed six to ten years.

Recurrence rates in all classes of hernias and all types of operations range from 0 per cent in the Cooper's ligament-fascial suture repair of primary hernias (forty-four cases) to 50 per cent in the McArthur fascial suture repair of recurrent indirect hernias (two cases). The overall recurrences total 177 cases or 6.7 per cent of the series. Wound complications at the time of operation or subsequently (Table v) include the inadvertent opening of the bladder during dissection of the sac, orchidectomy, temporary swelling of the homolateral testicle without subsequent atrophy, testicular atrophy, wound hematoma and wound infections in which there was purulent drainage with or without sloughing of the sutures. The pulmonary complications following operation consisted of atelectasis, two cases; bronchopneumonia, one case; and embolism (fatal), one case.

The inadvertent opening of the bladder, occurring in six cases in this series, is not an uncommon accident in hernia repair operations and in our experience has not been a serious complication. The bladder in each instance was opened during the dissection of the bladder from a direct sac or from the direct locule of a bilocular sac. In five of these patients healing was prompt and convalescence uneventful. The sixth developed an abscess in the prevesical space which required incision and drainage. Prompt closure of the bladder opening by means of interrupted sutures of fine catgut and an indwelling urethral catheter left in place continuously for fourteen days postoperatively are usually the only measures needed to prevent seepage of urine into the wound with resultant urinary fistula.

The low incidence of pulmonary complications we attribute to preoperative and postoperative management. No elective hernia operation is performed until the patient is free of symptoms of upper respiratory infection. Following surgery patients are encouraged to wave their arms about, talk, cough, breathe deeply and move their lower extremities. They are allowed out of bed to void on the day of operation and are encouraged to be up and out of bed for increasing periods of time daily from the first postoperative day. On the second or third postoperative day they walk to the toilet and to the solarium without assistance. Dressings are changed and alternate skin sutures are removed on the fifth day. The remaining sutures are removed and the last dressing applied on the seventh day. A shower bath is permitted on the eighth day and patients are discharged on the tenth to twelfth day following surgery.

Three deaths occurred as a result of or associated with operation. Autopsy revealed massive pulmonary embolism in one case and adynamic ileus in another. Permission for autopsy was refused in the third case and the cause of death was not determined.

The 2,643 hernias are classified as primary and recurrent and further subdivided into indirect, direct, bilocular, sliding, diverticular, adiposus and femoral. The indirect hernias are those in which the mural defect lies at the internal inguinal ring, the sac making its exit medial and adjacent to the spermatic cord, lateral to the inferior epigastric vessels and extending for a variable distance along the cord. Direct hernias are those in which the mural weakness or defect lies in the triangle (Hesselbach's) medial to the inferior epigastric vessels, above the inguinal (Poupart's) ligament, and lateral to the rectus muscle. Bilocular hernias have both a direct and an indirect component. This type of hernia is known also as the direct—indirect, saddlebag or pantaloon hernia. In sliding hernias the sac consists in whole or in part of an abdominal viscus usually the cecum and ascending colon or bladder on the right and the descending colon and sigmoid colon or bladder on the left.[4] Diverticular hernias are those in which herniation occurs through a defect in the transversalis fascia in the floor of the inguinal canal. Diverticu-

lar hernia sacs may or may not communicate with the peritoneal cavity. They may occur alone or in combination with other types of hernia. The fatty diverticulum is a rare variety of diverticular hernia consisting of a spherical, smooth, encapsulated, solitary, fatty mass protruding through a defect in the floor of the inguinal canal occasionally seen in obese patients who have attenuated or degenerated transversalis fascia.[3] Hernia adiposus results from the hypertrophy and downward progression of the finger-like extension of properitoneal fat which normally is seen adhering to the lateral aspect of the subaponeurotic portion of the spermatic cord.

Femoral hernias occur as a result of mural defects between the inguinal and iliopectineal ligaments and are almost invariably associated with indirect, direct, or bilocular inguinal hernias. For this reason they are classified as one type of inguinal hernia and the supraligamentous or inguinal approach is described and recommended in their treatment. The femoral sac or the femoral locule of an inguinofemoral sac may protrude from the abdominal cavity anterior to the external iliac vein and artery as a prevascular locule. It may pierce the lacunar (Gimbernat's) ligament adjacent and lateral to the pubic tubercle, the so-called translacunar locule. It may make its exit through the femoral canal which is bounded anteriorly by the inguinal (Poupart's) ligament, posteriorly by the iliopectineal (Cooper's) ligament, medially by the lacunar (Gimbernat's) ligament and laterally by the external iliac vein, a so-called pectineal locule. The femoral sac may consist of any two or all three of these locules. The femoral or infraligamentous incision provides access only to the femoral canal and that portion of the sac within and distal to it. Consequently with this incision exploration of the inguinal region is not possible unless the incision is extended upward through the inguinal ligament and inguinal hernia locules may be overlooked at operation. With the inguinal or supraligamentous incision exploration of both inguinal and femoral regions is possible and additional saccular or mural components of the hernia may be readily recognized and corrected without sacrificing the integrity of the inguinal ligament itself.

Herniorrhaphy and hernioplasty are the names given to the two classes of operative procedures employed in the repair of the hernias in this series.

HERNIORRHAPHY

Herniorrhaphy is the repair of hernia by means of the rearrangement of mural structures usually with funicular displacement without using fascial sutures or grafts and without muscle transplants. This operation has been chosen to close defects in the transversalis fascia and internal oblique muscle at or near the internal inguinal ring when the muscular and fascial structures seen at operation were considered sufficiently strong to prevent recurrence of the hernia following their approximation to the inguinal ligament or to Cooper's ligament by means of interrupted catgut or silk sutures.

In the routine herniorrhaphy performed at this hospital under spinal block or local anesthesia a 5 inch (12.5 cm.) incision is made through the skin and superficial fascia approximately 1 inch (2.5 cm.) above and parallel to the inguinal ligament. Vessels are isolated and clamped prior to division and then are tied with No. 000 catgut ligatures. The fibers of the external oblique aponeurosis are separated from the external inguinal ring upward and laterally for a distance of approximately 3 inches (7.5 cm.) or to a point slightly above and lateral to the internal inguinal ring, making a medial and a lateral aponeurotic flap. These flaps are then reflected medially and laterally, respectively. The spermatic cord is then elevated from its bed, divested of adherent areolar tissues and retracted laterally on a soft cotton or rubber tissue tape. The external spermatic veins frequently found on the posterior aspect of the cord are divided between hemostats and

ligated with No. 000 catgut ligatures at this stage. Upon careful examination of the medial aspect of the cord in any type of hernia, the sac can be found lying closely adherent to the medial side of the vas deferens in the region of the internal ring. The sac is then opened and explored digitally. Regardless of the type of hernia present the sac will be most easily dissected, delivered into the wound and ligated if pulled out through the internal ring lateral to the inferior epigastric vessels. This procedure obviates the opening of the transversalis fascia and prevents further damage to an already weakened wall. With small hemostats applied to the cut margin of the sac two fingers are inserted inside the sac and exploration is carried out to determine the true nature of the hernia.

It is almost impossible to classify an inguinal hernia accurately prior to exploration and so it is unwise to decide upon the exact type of repair to be carried out until all of the features of the sac and mural structures have been assessed under direct visualization and palpation. The exploration will reveal whether the sac is predominantly direct, indirect, or bilocular, whether or not there are associated diverticula, either communicating or not communicating with the peritoneal cavity and whether or not there is a femoral locule in addition to the inguinal locule or locules. After the completion of exploration traction is made on the margins of the sac and all surrounding structures are carefully dissected away up to the true neck of the sac. This point can be readily recognized by the narrowing just before the sac opens into the main peritoneal cavity. Dissection is not stopped when the bladder is encountered. In this series the bladder was dissected from the sac in direct or bilocular hernias for a distance of from 1 to 2 inches (2.5 to 5 cm.) in a total of 1,278 or 49 per cent of cases.

The sac is next twisted through a complete turn of 360 degrees and a purse-string suture of No. 0 black silk is placed twice about its extreme upper portion, above the neck if possible, tied, and the redundant portion of the sac amputated, whereupon, the ligated sac stump retracts out of sight behind the internal oblique muscle. Transfixion of this stump is not necessary if the purse-string suture is properly placed and snugly tied. High dissection, ligation and excision of the sac are essential in good hernia surgery. The ligated sac is the first line of defense against a recurrent hernia.

TABLE 1
HERNIORRHAPHY IN PRIMARY INGUINAL HERNIA

Classification of Hernias	Recurrences	Poupart's Ligament		Cooper's Ligament
		Catgut Sutures	Silk Sutures	Silk Sutures
Indirect	Cases	123	327	1
	Recurrences	9	23	0
	% Recurrence	7.3	7	0
Direct	Cases	11	92	12
	Recurrences	4	7	0
	% Recurrence	36	7.5	0
Bilocular	Cases	132	878	22
	Recurrences	14	56	0
	% Recurrence	10.6	6.3	0
Sliding	Cases	8	48	2
	Recurrences	1	8	0
	% Recurrence	12.5	17	0
Femoral	Cases	.....	12	21
	Recurrences	.....	1	2
	% Recurrence	.....	8.3	9.5
Adiposus	Cases	.....	5	
	Recurrences	.....	1	
	% Recurrence	.....	20	
Diverticular	Cases	.....	8	1
	Recurrences	.....	1	0
	% Recurrence	.....	12.5	0
Total	Cases	274	1370	59
	Recurrences	28	97	2
	% Recurrence	10	7	3.4

The fibers of the internal oblique muscle are now retracted medially and the transversalis fascia identified and cleared of

adherent muscle fibers and loose aerolar tissue. Diverticula in the floor of the inguinal canal are excised or inverted and the fascial defects are closed by means of purse-string sutures of No. 0 black silk prior to reconstruction of the abdominal wall. If the mural defect is small, fascial structures are strong and there is no associated direct or femoral hernia, herniorrhapy may be selected as the repair of choice. In this event slight tension is made on the lateral flap of the external oblique aponeurosis and all adherent bits of loose areolar tissue are wiped away from the flap and the inguinal ligament with a gauze sponge moistened in warm normal saline solution.

TABLE II
HERNIORRHAPHY IN RECURRENT HERNIA

Classification of Hernias	Recurrences	Poupart's Ligament		Cooper's Ligament
		Catgut Sutures	Silk Sutures	Silk Sutures
Recurrent indirect	Cases	7	15	1
	Recurrences	0	3	0
	% Recurrence	0	20	0
Recurrent direct	Cases	16	40	7
	Recurrences	2	2	1
	% Recurrence	12.5	5	14.3
Recurrent bilocular	Cases	1	22	5
	Recurrences	0	4	0
	% Recurrence	0	18	0
Recurrent femoral	Cases	....	12	6
	Recurrences	....	1	2
	% Recurrence	....	8.3	33.3
Totals	Cases	24	89	19
	Recurrences	2	10	3
	% Recurrence	8.3	11.2	15.7

The transversalis fascia is then approximated without tension to the shelving portion of the inguinal ligament with interrupted sutures of No. 000 black silk or No. 0 twenty-day chromic catgut in a line of sutures 5 to 8 mm. apart extending from the pubic tubercle to the internal inguinal ring.[1] A second row of interrupted sutures of the same material approximates the lateral flap of the external oblique aponeurosis to the transversalis fascia medial to the inguinal ligament. The medial flap of the aponeurosis is then imbricated over the lateral flap behind the spermatic cord and sutured to the inguinal ligament again using the interrupted sutures. The defect in the aponeurosis above and lateral to the exit of the cord created by the original separation of the medial and lateral flaps is then closed with one or two interrupted sutures of the silk or catgut. These latter sutures must not be placed tightly enough to constrict the cord and yet they must close the opening snugly so as not to leave an orifice large enough to permit recurrent herniation about the cord.

An opening large enough to accommodate the cord and the surgeon's fingertip is considered adequate to allow for postoperative edema in the cord without impairing its circulation. As can be seen, the spermatic cord is transposed extra-aponeurotically by the imbrication of the flaps. The skin and superficial fascia are approximated in one layer with interrupted on-end mattress sutures of a fine dermal suture material.

Primary and recurrent hernias (1,757 in all) were repaired by this procedure with silk and catgut sutures. There were 136 recurrences in this group, an average of 7.7 per cent; 1,370 primary hernias were repaired with silk with ninety-seven or 7 per cent recurrences. (Table 1.) The eighty-nine recurrent hernias repaired by means of herniorrhaphy with silk sutures resulted in ten or 11.2 per cent recurrences. (Table II.) In 298 of the herniorrhaphies performed with catgut sutures, thirty or 10.1 per cent recurrences developed. Of these, 274 were primary hernias in which twenty-eight, or 10 per cent of cases, developed recurrence subsequently. (Table 1.) Twenty-four recurrent hernias repaired with catgut by routine herniorrhaphy developed two or 8 per cent recurrences. (Table II.)

Complications following catgut herniorrhaphy consist of testicular atrophy in one patient. (Table v.) There were no wound infections or hematomas. Complications in the silk herniorrhaphy series were twenty-six wound infections, three wound hematomas, nineteen cases of testicular swelling without subsequent atrophy, eleven additional cases in which atrophy followed postoperative testicular swelling, four orchidectomies performed at time of operation and five cases in which the bladder was inadvertently opened during the dissection of the sac.

The incidence of recurrence and wound complications noted in this group of herniorrhaphies is in keeping with the results reported in recent years from other hospitals in various parts of the United States. Judging from these figures, silk sutures appear to offer the patient a better chance for cure of his hernia than do catgut sutures, provided herniorrhaphy is the indicated procedure and the same meticulous dissection and repair are carried out in all cases.

HERNIOPLASTY

Hernioplasty, the hernia repair in which fascial sutures or grafts or muscle grafts are transplanted to the hernia region to replace or strengthen relaxed or attenuated structures, was used in those cases in which such additional support was considered necessary at operation. However, in the past five years the indications for the use of fascial sutures and transplants have been recognized more and more often by our staff with a concomitant reduction in the recurrence rate of various types of hernia.

In the event the patient is found to have a direct hernia or if the mural defect is large, the abdominal wall is relaxed, if large diverticula are present in the floor of the inguinal canal, a femoral locule is present; if the patient has had a previous operative repair of a hernia with subsequent recurrence for any reason or if the muscular and fascial structures of the wall are absent or attenuated, a hernioplasty is the operation of choice. Very large mural defects are best repaired by means of pedicled fascia grafts according to Wangensteen's[8] method. General laxity of the abdominal wall, the presence of a femoral locule, absence or attenuation of the inguinal ligament or coexisting multiple locules are considered indications for the Cooper's ligament type of herniplasty.[5] Four types of hernioplasty, the Gallie,[6] the McArthur,[7] the Wangensteen pedicle fascia graft and Cooper's ligament repair were employed in a total of 808 or 30 per cent of the cases in this series.

TABLE III
HERNIOPLASTY IN PRIMARY HERNIA

Classification of Hernias	Recurrences	Poupart's Ligament		Cooper's and Poupart's Ligament	Cooper's Ligament
		Gallie Fascial Suture	McArthur Fascial Suture	Pedicled Fascia Grafts	Cooper's Ligament Fascial Suture
Indirect	Cases	76	15	1	3
	Recurrences	2	2	0	0
	% Recurrence	2.6	13.3	0	0
Direct	Cases	122	30	1	12
	Recurrences	4	3	0	0
	% Recurrence	3.2	10	0	0
Bilocular	Cases	190	94	2	11
	Recurrences	1	7	0	0
	% Recurrence	5	7.4	0	0
Sliding	Cases	52	11	2	6
	Recurrences	0	0	0	0
	% Recurrence	0	0	0	0
Femoral	Cases	1	.....	..	11
	Recurrences	0	.....	..	0
	% Recurrence	0	.....	..	0
Adiposus	Cases	8	3		
	Recurrences	0	0		
	% Recurrence	0	0		
Diverticular	Cases	11	3	..	1
	Recurrences	0	0	..	0
	% Recurrence	0	0	..	0
Total	Cases	460	156	6	44
	Recurrences	7	12	0	0
	% Recurrence	1.5	7.6	0	0

The Gallie hernioplasty consists of high ligation and excision of the sac, approximation of the transversalis fascia to the

shelving portion of the inguinal ligament, imbrication of the medial and lateral flaps of the external oblique aponeurosis with extra-aponeurotic transposition of the spermatic cord using one or two sutures of fascia obtained from the iliotibial tract

TABLE IV
HERNIOPLASTY IN RECURRENT HERNIA

Classification of Hernias	Recurrences	Poupart's Ligament		Poupart's and Cooper's Ligament	Cooper's Ligament
		Gallie Fascial Suture	McArthur Fascial Suture	Pedicled Fascia Grafts	Cooper's Ligament Fascial Suture
Recurrent indirect	Cases	17	2	1	2
	Recurrences	1	1	0	1
	% Recurrence	6	50	0	50
Recurrent direct	Cases	42	..	11	9
	Recurrences	3	..	0	0
	% Recurrence	7	..	0	0
Recurrent bilocular	Cases	35	..	4	4
	Recurrences	3	..	1	1
	% Recurrence	8.5	..	25	25
Recurrent sliding	Cases	....	..	1	
	Recurrences	....	..	0	
	% Recurrence	....	..	0	
Recurrent femoral	Cases	1	..	10	2
	Recurrences	0	..	4	1
	% Recurrence	0	..	40	50
Recurrent diverticular	Cases	....	..	1	
	Recurrences	....	..	1	
	% Recurrence	....	..	100	
Totals	Cases	95	2	28	17
	Recurrences	7	1	6	3
	% Recurrence	7.3	50	21.8	17.6

of the fascia lata. This hernioplasty differs from the herniorrhaphy previously described only in that continuous running sutures of fascia are used in the fascia to ligament approximation in place of the interrupted silk or catgut sutures used in the herniorrhaphy.

The fascial sutures are removed through a transverse incision 3 cm. long on the lateral aspect of the thigh one hand's breadth distal to the greater trochanter of the femur. Through this small incision one or more sutures 3 or 4 mm. wide and averaging 20 to 25 cm. in length may be readily removed with a Masson fascia stripper. The process of extracting the suture is facilitated by internally rotating and immobilizing the donor extremity prior to making the incision. This can be done by slipping a small, snugly fitting half sandal over the forepart of the foot and attaching this sandal to the opposite side of the operating table by a connecting strap.[2] As soon as the fascial suture has been removed from the thigh, it is fixed at one end to a large-eyed curved steel needle by means of No. 000 black silk ties. Sutures and attached needles are then placed in a gauze sponge previously moistened with normal saline solution at room temperature to be kept until the actual time of suturing. It is important that the sponge not be hot, else the suture will be partially cooked, will swell, lose its elasticity and tensile strength and will slough out of the wound two to four weeks later. Sloughing will also occur if the suture is allowed to dry out before use.

Removal of the fascial suture from the thigh results in little additional postoperative pain for the patient. The discomfort subsides as rapidly as that in the inguinal wound and not one of our patients has complained of postoperative weakness in the donor thigh.

The Gallie hernioplasty was chosen in the treatment of 555 patients of whom 460 had primary hernias (Table III) and ninety-five had recurrent hernias. (Table IV.) The recurrences following the repair of primary hernias varied from 0 per cent in the sliding, femoral and diverticular hernias to 3.2 per cent in the direct hernias with an overall recurrence rate of 1.5 per cent. The recurrent hernias repaired by the Gallie technic varied from 0 per cent recurrence in one femoral hernia to 8.5 per cent in the bilocular group with an overall recurrence rate of 7.3 per cent. The Gallie operation is not ordinarily considered suitable for femoral hernias; however, this operation was chosen by one of our surgeons in the treatment of one patient with a

primary femoral hernia and another with a recurrent femoral hernia with satisfactory results in both so far. The complications following the Gallie operation (Table v) consist of wound infections in seven cases, wound hematoma in one case, testicular swelling in three cases, testicular atrophy in six cases and orchidectomy in one case. There were no deaths in this group and the bladder was not opened during dissection.

TABLE V
WOUND COMPLICATIONS

	Poupart's Ligament Herniorrhaphy				Cooper's Ligament Herniorrhaphy Silk Sutures		Gallie Hernioplasty Fascial Suture		McArthur Hernioplasty Fascial Suture		Hernioplasty Pedicled Fascia Graft		Cooper's Ligament Hernioplasty Fascial Suture	
	Catgut Suture		Silk Sutures											
Number of operations...	298		1459		78		555		158		34		61	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Wound infections.....	0	0	26	1.7	2	2.5	7	1.2	2	1.2	1	3	2	3.2
Wound hematomas.....	0	0	3	.2	0	0	1	.18	0	0	0	0	0	0
Swollen testicle without atrophy.....	0	0	19	1.3	0	0	3	.5	0	0	1	3	0	0
Testicular atrophy.....	1	.3	11	.6	0	0	6	1	0	0	1	3	1	1.6
Orchidectomy at operation.....	0	0	4	.3	0	0	1	.18	0	0	1	3	1	1.6
Bladder opened.....	0	0	5	.3	0	0	0	0	1	.6	0	0	0	0

The McArthur hernioplasty is similar to the Gallie hernioplasty in that a fascial suture is used to approximate the transversalis fascia to the inguinal ligament and the medial and lateral flaps of the external oblique aponeurosis are imbricated superficial to the transversalis fascia allowing extra-aponeurotic transposition of the spermatic cord. The difference in the two operations lies in the difference in the origin of the fascial sutures. The suture in the McArthur hernioplasty is derived from the edge of the medial flap of the external oblique aponeurosis. A suture 2 or 3 mm. wide is split from the aponeurosis beginning at its lateral extremity at the point of insertion of the muscle fibers down to its tendonous insertion into the pubic tubercle. The lower end of the suture is not freed from its bony attachment. A large eyed, curved steel needle is affixed to the free end of the suture by means of a No. 000 black silk tie and this suture is used to approximate the transversalis fascia to the inguinal ligament. The fascial suture is not long enough to allow completion of the imbrication of aponeurotic flaps after the original fascia to ligament closure so that it becomes necessary to suture the lateral flap to the transversalis fascia and the medial flap to the inguinal ligament with interrupted sutures of No. 00 black silk.

There were 158 patients who received the McArthur hernioplasty. One hundred fifty-six of them had primary hernias (Table III) and two had recurrent hernias. (Table IV.) There were no recurrences in the primary sliding and diverticular hernias. Recurrences in the bilocular hernia, direct hernias and indirect hernias were 7.4, 10 and 13.3 per cent, respectively, with a total recurrence rate of 7.6 per cent. Of the two recurrent indirect hernias repaired by the McArthur technic one recurred a second

time leaving a recurrence rate of 50 per cent. The recurrence rate for the 158 cases is 8.2 per cent, a figure slightly higher than that in the silk herniorrhapy series (Tables I and II) and considerably higher than the recurrence rate in the Gallie fascial suture group.

Complications resulting from the McArthur hernioplasty (Table V) were two wound infections, and one case in which the bladder was inadvertently opened during the dissection. There were no instances of wound hematomas, swollen testicles, testicular atrophy, or orchidectomy following this operation.

In thirty-four patients large hernias secondary to major defects in the fascial components of the abdominal wall were repaired with pedicled grafts from the iliotibial tract of the fascia lata from the homolateral thigh. In this operation the sac is dissected, ligated and excised in the usual manner; the inguinal ligament, transversalis fascia and Cooper's ligament are identified and freed of adherent structures. Then a vertical incision 20 cm. long is made along the lateral aspect of the thigh beginning a hand's breadth below the greater trochanter of the femur. The skin and superficial fascia are retracted on either side of the wound and a pedicled graft 4 to 5 cm. wide attached at its upper end to the tensor fascia lata muscle containing the entire iliotibial tract of the fascia lata is freed from the underlying muscle. Its free distal end is turned upward and passed beneath the skin and superficial fascia of the thigh through the femoral canal into the inguinal region in the manner described by Burton and Ramos.[5] The graft is then fanned out to cover the defect in the transversalis fascia. The free edges of the graft are sutured to the transversalis fascia or rectus sheath above and medially and to the inguinal ligament and Cooper's ligament laterally and below by means of interrupted sutures of No. 00 black silk. The medial and lateral flaps of the external oblique aponeurosis are imbricated using interrupted sutures of No. 00 black silk further strengthening the graft and transposing the spermatic cord outside the aponeurosis. The skin and superficial fascia of both wounds are approximated with interrupted on-end mattress sutures of No. 000 dermal. Hemostasis and strict asepsis are especially important in this operation because of the extent of the dissection and the danger of contamination in the transfer of the graft from the thigh through the femoral canal into the inguinal region.

Recurrences in this series varied from 0 per cent in the indirect, direct, bilocular, sliding, recurrent indirect, recurrent direct and recurrent sliding hernias to 25 per cent in the recurrent bilocular hernias, 40 per cent in the recurrent femoral hernias and 100 per cent in the one recurrent diverticular hernia. Complications consist of one wound infection, one case of testicular swelling without subsequent atrophy, one testicular atrophy, and one orchidectomy performed at the time of operation. There were no postoperative wound hematomas and the bladder was not entered during the sac dissection.

Cooper's ligament operation is indicated in the treatment of all femoral hernias including combined inguinofemoral hernias. Other indications for this type of repair are inguinal hernias associated with attenuation or absence of the inguinal ligament and those hernias accompanied by marked laxity of the abdominal wall.

Cooper's ligament is a tough fibrous band which extends laterally from the lacunar ligament lying closely adherent to the pectineal line of the superior pubic ramus. This ligament offers a superb anchorage for the fascial strata of the abdominal wall from the lacunar ligament laterally to the external iliac vein. It is readily accessible and is available when exclusion of the femoral canal is desired or when the inguinal ligament is inadequate for inguinal reconstruction. In this series Cooper's ligament has been utilized in a total of 139 cases. In seventy-eight or 57 per cent of these patients the herniorrhaphy type of

operation was done. In this procedure the transversalis fascia is sutured to Cooper's ligament with interrupted No. 0 black silk sutures after the sac has been dissected, ligated and excised. The aponeurotic flaps are then imbricated and the spermatic cord transposed extra-aponeurotically. In sixty-one patients receiving hernioplasty, the fascia to ligament approximation was completed with the aid of a continuous fascial suture running from the pubic tubercle to the external iliac vein and then the space between the inguinal ligament and Cooper's ligament was obliterated through the use of a second fascial suture which pulled the inguinal ligament down to close proximity with the superior pubic ramus.

There were five recurrences (6.4 per cent of cases) in the seventy-eight patients receiving Cooper's ligament herniorrhaphy with silk sutures. Wound infection followed operation in two instances. There were no other complications in this group.

There were three recurrences (4.8 per cent of cases) in the sixty-one patients receiving Cooper's ligament hernioplasty with fascial sutures. Infection developed in two of these wounds and additional complications consisted of testicular atrophy in one patient and orchidectomy in one other.

CONCLUSIONS

A study of 2,040 patients in the U. S. Veterans Administration Hospital in Dayton, Ohio, operated upon for 2,369 primary and 274 recurrent inguinal hernias over a period of eleven years indicates a trend recently toward the use of fascial sutures and fascial grafts in hernia repair operations. A concomitant drop in the recurrence rates of many types of hernia apparently justifies this trend. Hernioplastic procedures are generally more difficult to perform and are more time consuming than are herniorrhaphies, but the incidence of cure is so much higher in the former that the additional time required appears to be well spent. In our experience there are no more wound infections or other complications following the use of fascia lata sutures and grafts than are encountered when silk sutures are used.

The McArthur fascial suture hernioplasty has been almost entirely eliminated from our armamentarium as a result of our studies of recurrence rates in the various methods of repairing hernias. We have found this operation somewhat less effective than herniorrhaphy with silk sutures and decidedly inferior to the Gallie fascial suture hernioplasty.

The Wangensteen pedicled fascia graft operation is reserved for those patients with large defects in the fascia of the abdominal wall which cannot be adequately closed by procedures requiring less extensive dissection.

Cooper's ligament offers a firm anchorage for the transversalis fascia and for the external oblique aponeurosis when exclusion of the femoral canal is necessary or when the inguinal ligament is absent or insufficiently strong to insure satisfactory inguinal reconstruction.

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FRACTURE FIXATION BY TRANSARTICULAR PIN*

A TECHNIC FOR CONTROL OF SEVERE ANKLE FRACTURES

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TRIMALLEOLAR fracture of the ankle may be extremely disabling. A major cause of disability may be the difficulty in maintaining reduction. Open reduction and internal fixation of the displaced posterior fragment is often indicated; however, such a procedure is technically difficult and permanent limitation of motion with pain may still result after surgical intervention. Another alternative, skeletal fixation above and below the fracture incorporated in the cast has not been as successful as might be desired.

A removable partially intramedullary transarticular pin has been used successfully to maintain reduction in this difficult multiple fracture involving the joint.

In rationalizing such an approach the additional damage to the joint surface of a small pin perforation seemed negligible compared with the initial traumatic damage. The technic is simple. At the time of election, after surgical preparation of the extremity, a pin is applied through the calcaneus for application of traction by clevis. By traction and gentle manipulation, reduction of the fracture dislocation can usually be effected. A small gauge Steinman pin is then inserted with a motor drill from the medial aspect of the tibial cortex about 3 inches above the ankle joint. This pin is passed through the intramedullary canal of the tibia, across the joint, through the talus and finally emerges lateral to the calcaneus in a silent area, thus maintaining inversion of the ankle. The point does not come through the skin. The heel traction pin is removed and a short leg plaster cast is applied incorporating the cork-tipped upper end of the transarticular pin. The cast and pin are removed in six weeks. At this time, in the presence of *x*-ray evidence of callus, gentle mobilizing exercises and underwater therapy are instituted. Weight bearing is allowed after mobilization when the clinical and *x*-ray appearance show adequate healing.

Two illustrated cases are presented. One, the common trimalleolar fracture with posterior displacement of the foot, and two, a trimalleolar fracture with a more uncommon anterior displacement of the foot. In both of these, initial attempts at plaster immobilization were unsatisfactory. This procedure was carried out, reduction was obtained by skeletal traction and fixation was positive by the transarticular pin and short cast.

SUMMARY

Reduction can be well maintained in trimalleolar ankle fractures by use of the transarticular pin. It is probable that this technic will decrease the incidence of open reductions for such fracture dislocations and also decrease the permanent disability following such injury.

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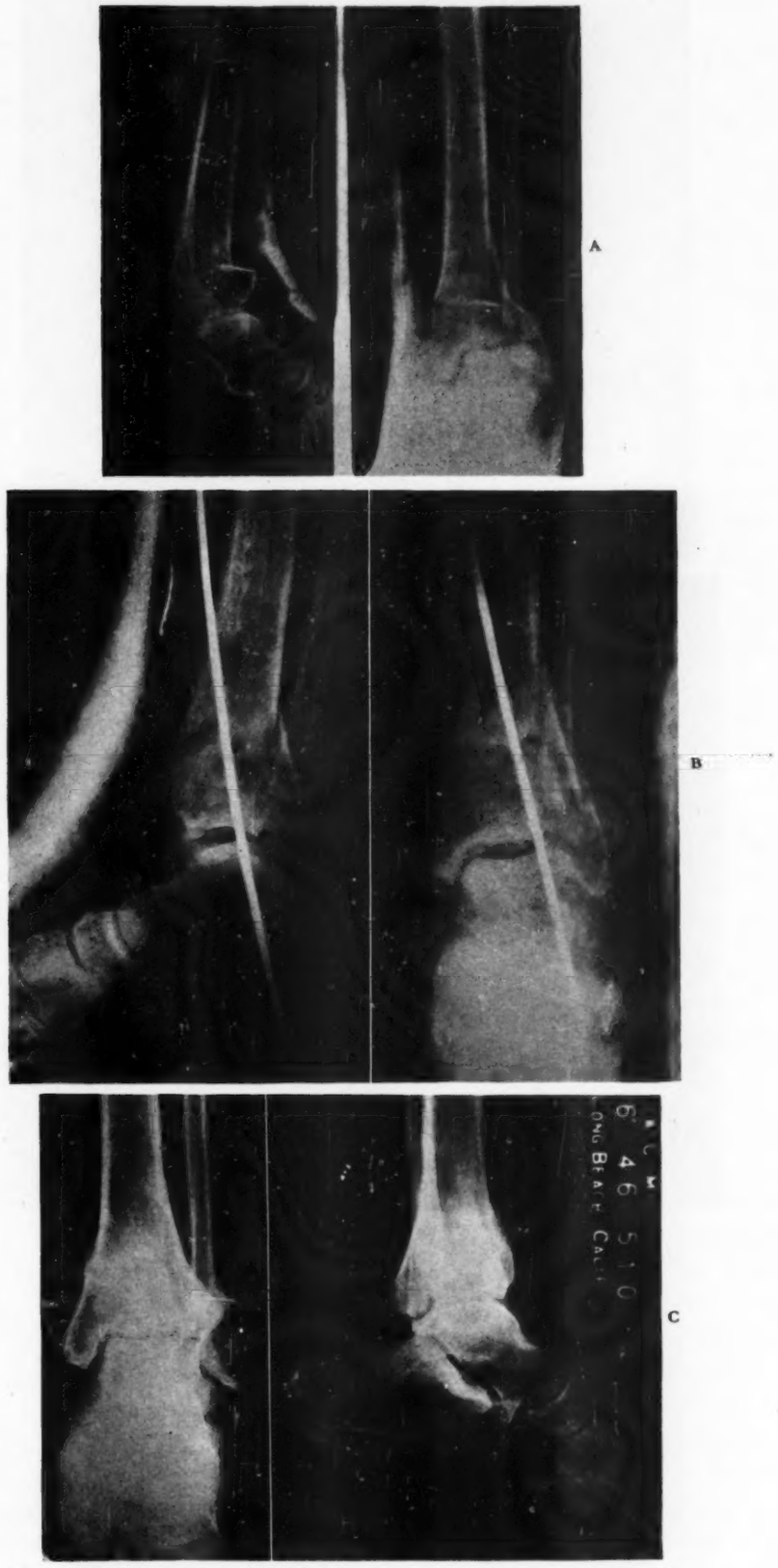

Fig. 1. Case 1. M. D., white female, sixty-two years of age. A, unsatisfactory closed reduction; B, after application of transarticular pin; C, end result; full motion, good function.

Fig. 2. Case II. W. L., white male, thirty years of age. A, marked displacement of fragments; B, fixation by transarticular pin; C, appearance after removal of pin.

CHOLECYSTITIS AND CHOLELITHIASIS IN THE YOUNG*

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IT is a well known fact that cholecystitis and cholelithiasis occur primarily between the ages of thirty and fifty. The typical gallbladder patient has often been described by the old saying: fat, female, fair and forty. This picture was so well entrenched in the minds of most clinicians that for many years very little attention was paid to the problem of cholecystitis in the young. In fact, until the 1920's, this condition in a patient below the age of fifteen was considered a rare clinical entity warranting the publication of a case report.

Since that time, however, interest in this problem has been stimulated sharply by the comprehensive studies of Kellog, Beals and Potter. Kellog[1] reported sixty-four cases in 1923, and in 1928 Beals[2] was able to collect 124 cases. Prior to this time there is only one report of a fairly large group of collected cases to be found in the literature. This is in a paper published by Still[3] in 1899, describing twenty cases of biliary calculi in children and it represents one of the earliest attempts to explore the subject thoroughly. It was Potter,[4] however, who directed attention to this disease in patients under fifteen years of age by reporting a total of 226 collected cases in 1928. In the ten-year period from 1928 to 1938, Potter[5] discovered 206 additional patients, increasing his total of personal and collected cases to 432.

Recent authors undoubtedly influenced by these statistical studies no longer consider gallbladder disease an unimportant condition in children. In fact, it seems that there is a tendency by some clinicians to become too enthusiastic in their claims. Seidler and Brakeley[6] contend that the collected cases represent "but a merest fraction of the number of children afflicted."

It should be emphasized, however, that statistical data can be misleading unless a careful study is made of the types of cases presented. Twenty-six of the cases reported by Potter were congenital abnormalities of the biliary tract that occurred in the fetal or neonatal period. A good many other cases were also included which, strictly speaking, did not actually have primary gallbladder disease. Furthermore, in approximately 25 per cent of the cases, the diagnosis was based only on symptoms which are often misleading in children. It would appear, therefore, that the incidence of cholecystitis and cholelithiasis in the young is still infrequent but certainly not as rare as was formerly believed.

In order to study this problem from the clinical viewpoint, a survey was made of all the cases of cholecystitis in those patients under twenty-one seen at the Charity Hospital of Louisiana, New Orleans, from 1938 to 1935.

A total of twelve cases were reportable either on the basis of pathogenic findings or strong clinical evidence. There were ten additional cases that showed some clinical and laboratory evidence of gallbladder disease which may have been sufficient to warrant surgery if the patients had fallen into an older age group. Since these patients ranged from fifteen to twenty years of age, they were discharged on conservative management. No follow-up records were available to determine whether they have had persistent symptoms or subsequent operation. Because the evidence in these ten patients was not conclusive, their case reports were eliminated from this series. In addition, since this paper is devoted to the discussion of acquired gallbladder disease, primarily cholecystitis

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and cholelithiasis, no congenital lesions such as biliary atresias were considered.

Table I shows the age distribution of the patients whose case records are given below:

TABLE I

Age Group	No. of Cases
0– 5	0
6–10	1
11–15	0
16–20	11

The only male in the series was a seven year old boy in whom the diagnosis of chronic cholecystitis was made at operation. The remaining eleven patients were female, and their ages ranged from fifteen to twenty. Racial distribution played no significant rôle, six patients being white and six colored.

Six of the twelve patients were considered to have cholelithiasis. In four, the diagnosis was verified by actual demonstration of stones at operation. In the remaining two cases, no operation was performed but the diagnosis was made on the basis of typical attacks of biliary colic with evidence of mild jaundice. It is of interest to note that only one patient was shown to have stones on *x*-ray. In all the others, the *x*-ray revealed non-visualization of the gallbladder.

Table II shows the incidence of pregnancy in the eleven female patients presented in this review. Eight, or 73 per cent of the eleven females had been or actually were pregnant at the time of hospitalization. Five or 62 per cent of the eight patients were also found to have cholelithiasis. The only patient who had cholelithiasis without a history of pregnancy developed typhoid fever during convalescence.

TABLE II

Type of Case	Pregnant Cases	Non-pregnant Cases	Total
All cases	8	3	11
Surgically treated	5	3	8
Cases with stones	5	1	6

Table III indicates the basis for the diagnosis made in these patients.

TABLE III

Diagnosis Made by	No. of Cases
Symptoms	2
Operation	9
Autopsy	1

CASE REPORTS

CASE I. L. M. C., a colored female, aged twenty, was admitted to The Charity Hospital October 3, 1939, with the complaint of severe pain in the epigastrium and vomiting of two days' duration. At first the pain was cramping and colicky in nature but it soon became constant. In the previous three years the patient had suffered four or five such attacks, which were precipitated by the ingestion of greasy foods or sea food. There was a history of chronic constipation. The patient denied pregnancy but the presence of abdominal striae and pigmentation of the areolas of both breasts was considered as possible evidence of a previous pregnancy. Physical examination revealed an obese patient with a temperature of 99°F., and a blood pressure of 120/70; the abdomen showed marked tenderness in the right upper quadrant; the red blood cells were 3.8 million; white blood cells, 7,500 and the urine was negative for bile. The Kolmer and Kline tests were positive; cholecystogram failed to visualize the gallbladder. Cholecystectomy was performed four days after admission. The pathological report revealed the presence of subacute and chronic cholecystitis and cholelithiasis. The patient developed a pneumonitis postoperatively but made an uneventful recovery permitting her discharge on October 17, 1939. Four months later she returned to the clinic suffering from an incisional hernia and diabetes; however, her gallbladder symptoms had disappeared.

CASE II. L. S., a nineteen year old white female, was admitted April 25, 1938, with sharp, colicky pains in the right upper quadrant of the abdomen. She had experienced six or seven similar attacks during the previous six weeks, each being precipitated by the ingestion of greasy foods. There was a history of two previous pregnancies, with one living child as the result. Physical examination revealed an obese white female with a temperature of

98.6°F.; blood pressure 150/100 and a tenderness in the upper right quadrant of the abdomen. The laboratory data revealed the red blood cells, 5.3 million; white blood cells, 8,000; 87 per cent polymorphonuclears and an icterus index of 16. No bile was present in the urine. A cholecysotgram failed to visualize the gallbladder. After one week in the hospital, the patient was discharged on medical management with a clinical diagnosis of cholecystitis and cholelithiasis.

Case III. E. C. A., a nineteen year old white female, was admitted January 14, 1939, in the eighth month of her first pregnancy with dyspnea, edema, weakness, absent fetal movements and frequent vomiting. Examination revealed marked cyanosis, râles at both lung bases and an enlarged heart with a to and fro murmur. There was a pitting edema of both legs; the fetal heart tones were absent. The patient died the day after admission because of heart failure and bronchopneumonia. At autopsy, chronic glomerulonephritis and chronic cholecystitis were found. This case was included on the basis of autopsy findings.

Case IV. E. U., an eighteen year old colored female, was admitted August 16, 1940, with constant pain in the right subcostal region of the abdomen of six days' duration. The pain radiated across the epigastrium and to the right shoulder; there was no vomiting or diarrhea. The patient was greatly distressed by much eructation and "bloating." For one year she complained of a definite qualitative dyspepsia for fats but she denied any previous attack of pain. The patient had been married one and one-half years but had never been pregnant. Physical examination revealed a colored female in moderate distress, with a temperature of 100°F.; pulse 96; blood pressure 120/78 and a tenderness and rigidity in the right upper quadrant of the abdomen. A small, rounded, tense mass was palpable in the right subcostal region. The liver and spleen were not palpable. The laboratory data showed red blood cells, 4.1 million; white blood cells, 14,000; 89 per cent polymorphonuclears and the urine negative for bile. The stools were normal. The Kline and Kolmer tests were strongly positive. Cholecystectomy was performed on August 17, 1940. The operator reported that "numerous dense adhesions" were found, which "caused angulation and dyskinesia." The pathological report showed "chronic cholecystitis with early acute cholecystitis." The patient left the hospital August 27, 1940 entirely free of symptoms.

Case V. A. P. C., a nineteen year old white female and the mother of two children, was admitted August 18, 1940, complaining of an intermittent colicky pain in the right lower quadrant of the abdomen with radiations to her back. She had suffered similar attacks each month since her last pregnancy eleven months prior to admission. Each attack was accompanied by vomiting which seemed to relieve the pain. She gave no history of food dyscrasia, diarrhea or jaundice. During an appendectomy three months earlier, stones had been palpated in the gallbladder. Physical examination revealed a moderately sick colored female with a temperature of 98.6°F., blood pressure 160/100 and tenderness in the right upper quadrant of the abdomen. The icterus index was 16.5, blood cholesterol 275 mg. per cent, blood urea nitrogen 12.6 mg. per cent, and the stool examination was normal. Cholecystectomy was performed at which time stones were found in the gallbladder and the cystic duct. The wound was closed with drainage of the gallbladder bed. The pathological report was "chronic cholecystitis and cholelithiasis with Rokitansky-Aschoff sinuses in the wall." The patient, symptom-free, was discharged September 5, 1940.

Case VI. S. M. P., an eighteen year old white female, was admitted August 14, 1941, with the chief complaint of vomiting and cramping epigastric pains, which radiated to the right shoulder. She had experienced three to four similar attacks during a period of six weeks prior to admission. The patient had been bothered by "eructation, flatus and indigestion" for a year. A self-imposed diet which she had followed during this time resulted in a weight loss of 38 pounds. Shortly before admission she developed an aversion to fatty foods and noted that at times her urine became highly colored. Physical examination revealed a temperature of 98.4°F., blood pressure 100/15 and a tenderness in the right upper quadrant of the abdomen. The laboratory data showed red blood cells, 4.2 million; white blood cells, 11,200; 72 per cent polymorphonuclears; icterus index 7; blood urea nitrogen 9.1 mg. per cent; cholesterol 150 mg. per cent and the prothrombin time was 80 per cent of normal. A cholecystogram showed good visualization with a 60 per cent emptying for a fat meal but there were multiple negative shadows in the gall-

bladder. On August 28, 1941 cholecystectomy and choledochostomy were performed. The pathological report showed "chronic cholecystitis with mixed stones." On September 12, 1941, the patient developed a chill followed by persistent high fever. On September 19, 1941, Escherichia typhosi organisms were cultured from the blood and the draining bile. She gradually recovered and became afebrile October 15, 1941. The T-tube was removed on October 20, 1941 and the patient was discharged the following day.

Case VII. A. L. J., an eighteen year old white female, was admitted August 5, 1943. Two weeks after the birth of her child (aged four months), she began to have attacks of colicky pain in the epigastrium and the right upper quadrant of the abdomen with radiations to the back and right shoulder. Each attack lasted several hours and was accompanied by nausea and vomiting. The pain was precipitated and aggravated by ingestion of greasy foods. She noticed no jaundice at any time, but gave a history of chronic constipation. Physical examination performed between attacks showed no evidence of biliary tract disease. The laboratory data showed no abnormality, except for the cholecystogram, which revealed one positive and numerous negative shadows in the gallbladder. There was 50 per cent emptying. On August 17, 1943, cholecystectomy and choledochostomy were performed and many small stones were removed. The patient improved rapidly after operation and was discharged August 31, 1943.

Case VIII. S. B., an eighteen year old colored female and the mother of one child, was admitted August 6, 1943, with radiating pain in the upper right quadrant of the abdomen as well as vomiting. She gave a history of appearing jaundiced several times during the four months prior to admission. She also experienced intermittent attacks of pain which were precipitated by ingestion of "cabbage and beans." Physical examination revealed an obese colored female with a temperature of 100°F., and a tenderness in the right upper quadrant of the abdomen. The laboratory report showed hemoglobin 82 per cent; white blood cells 10,750 and 82 per cent polymorphonuclears. The urine was positive for bile and urobilinogen; the stools were normal. Blood chemistry revealed an icterus index of 25, cholesterol 185 and a prothrombin time of 71 per cent of normal. The cholecystogram failed to visualize the gallbladder. Clinical impression was cholecystitis with cholelithiasis but the patient refused operation and left the hospital August 13, 1943.

Case IX. N. L. S., a sixteen year old colored female, admitted December 10, 1943, with cramping intermittent pain of five hours' duration in the right lower quadrant of the abdomen. She had experienced several similar attacks in the previous five months. The patient had been pregnant eighteen months prior to admission. She gave no history of any food dyscrasia. Physical examination revealed a temperature of 101.6°F., pulse 104, blood pressure 140/84 with tenderness and moderate rigidity in the lower right quadrant. The laboratory report showed red blood cells, 3.3 million, white blood cells, 12,000, polymorphonuclears 76 per cent and normal stools. Appendectomy was performed but at operation it was found that the gallbladder was acutely inflamed and it was removed at the same time. The pathological report showed "chronic periappendicitis and chronic cholecystitis with Rokitansky-Aschoff sinuses in the wall." The patient was discharged December 21, 1943 after an uneventful postoperative course.

Case X. D. H. A., an eighteen year old white female, was admitted January 30, 1944, complaining of frequent vomiting and constant pain of seventeen hours' duration in the right upper quadrant of the abdomen. One week previously she had suffered from a similar attack of pain which lasted only thirty minutes. The patient was married but gave no history of any pregnancy, food dyscrasia, constipation or jaundice. Physical examination revealed an obese white female with a temperature of 101.8°F.; pulse 120; blood pressure 140/82 and tenderness in the right epigastric region. A flat plate of the abdomen showed no evidence of calculi. The laboratory findings were as follows: red blood cells 5.1 million; white blood cells 11,850; 89 per cent morphonuclears, the urine and stool examinations negative, icterus index 16.6 and cholesterol 111 mg. per cent. On January 30, 1944, appendectomy and cholecystectomy were performed. Fibrinous adhesions were found between the gallbladder and omentum but stones were not present. The pathological report showed "acute and chronic periappendicitis and early acute cholecystitis." The patient developed a wound abscess which

was opened on the tenth postoperative day. She was discharged February 20, 1944, entirely free of symptoms.

Case XI. M. B., a nineteen year old colored female, was admitted March 31, 1944, with constant pain in the right side of her abdomen of sixteen hours' duration. She had vomited five or six times at the onset of illness. There was no history of jaundice nor of previous attacks of pain. The patient was in the fifth month of her first pregnancy. Physical examination revealed an obese colored female with a temperature of 99.8°F., pulse 108, blood pressure 116/80 and tenderness and rigidity in the upper right quadrant of the abdomen. The uterine fundus was at the level of the umbilicus. The laboratory work showed hemoglobin 73 per cent, white blood cells, 20,300, 96 per cent polymorphonuclears and other findings that were essentially normal. At operation the gallbladder was found to be tense, indurated, edematous and surrounded by numerous pericholecystic adhesions. The diagnosis of acute cholecystitis was made and cholecystostomy was performed. The tube was removed on the fourteenth postoperative day. She was discharged April 16, 1944 and her pregnancy terminated normally June 28, 1944.

Case XII. J. W., a seven year old colored male, was admitted October 9, 1944, with intermittent abdominal pain of seven hours' duration. He had vomited three times since the onset of illness. There was no history of any previous attacks, no jaundice and no food dyscrasia. Physical examination revealed a colored child with a temperature of 98.8°F. and a pulse of 90. Abdominal tenderness was most marked in the right upper quadrant but was also present in the left upper and right lower quadrants. One examiner found that the gallbladder was "questionably palpable." The hemoglobin was 79 per cent, white blood cells, 11,000, 77 per cent polymorphonuclears and other laboratory findings were reported as normal. The preoperative impression was acute appendicitis, but at operation not only was the appendix inflamed but the gallbladder was found to be markedly distended by "cystic duct obstruction due to an inflammatory lymph node." Cholecystectomy and appendectomy were performed. The pathological report showed "slight subacute and chronic cholecystitis and acute appendicitis." The lymph node enlargement was caused by non-specific reticulum cell hyperplasia. The patient was discharged October 25, 1944.

COMMENTS

From the material presented in this report, it appears that when all the cases presented in the literature are carefully evaluated, the incidence of acquired gallbladder disease in individuals below the age of fifteen is still low. The only patient in this age group (Case XII) was diagnosed as an acute appendicitis at operation. The incidental finding was a distended gallbladder caused by an enlarged lymph node obstructing the cystic duct. The pathological condition in this patient is very similar to that found by Seidler and Brakeley[6] in the case which they reported. The low incidence of cholecystitis in patients under fifteen years of age found in this group is substantiated by Bearse[7] in his report on sixty-three cases of gallbladder disease in patients under the age of thirty. Of these, there was only one patient below the age of fifteen and three below the age of twenty.

In general, young patients with biliary tract disease can be divided into three main groups according to the ages. In the neonatal period and very early childhood the congenital lesions of the biliary system are present. These include the various types of atresias and obstructions of the common duct due to inspissated bile.

In the late childhood period a number of cases of cholecystitis with or without cholelithiasis have been reported from time to time. In these patients there is usually a history of a preceding or intercurrent infectious disease; scarlet fever, diphtheria, influenza and typhoid fever have been frequently implicated. The importance of an infectious disease as an etiologic factor in the development of gallbladder disease in children has been emphasized by most of the authors who have written on this subject. It should be mentioned that acute inflammation of the gallbladder in this age group rarely progresses to suppuration. Usually the condition subsides sponta-

neously. For this reason, the diagnosis in children in all likelihood is frequently overlooked. Certainly it is possible that such patients may have a tendency to develop serious gallbladder disturbances at some later date.

The third period is that following puberty, or the very young adult (fifteen to twenty years of age). In this age group the disease is similar to that which occurs in older patients. Apparently the same relatively little known factors that are at work in older gallbladder patients can also be found in young adults.

The clinical picture in the reported cases was fairly typical. Epigastric and right upper quadrant pain with radiation to the back, nausea and vomiting, qualitative dyspepsia, eructation and flatulence were all prominent symptoms. To make the correct diagnosis in young individuals, clinical judgment is more important than laboratory evidence. Non-visualization of gallbladder was the most significant *x*-ray finding. In order to make an early, correct diagnosis in these patients, the clinician must have a high index of suspicion. If the possibility is not considered, the diagnosis will be missed and adequate treatment will be delayed.

There was no operative mortality in this series.

The high incidence of pregnancy in these patients is of great interest. Middleton,[8] Friedenwald[9] and others have emphasized the importance of pregnancy as a causative factor in the development of cholecystic disease in older age groups. Undoubtedly it also plays a significant rôle in those patients under the age of twenty. In fact, a number of the patients seemed to date their illness from their pregnancy.

SUMMARY

1. Twelve cases of cholecystitis and cholelithiasis in the young are reported.

2. The pertinent literature has been reviewed.

3. Adult factors, such as pregnancy, play an important rôle in the development of gallbladder disease despite the fact that these patients were under twenty years of age.

4. Cholecystitis in childhood (below the age of fifteen) is still an infrequent condition but is not as rare as was formerly believed.

5. Cholecystitis in females between the ages of fifteen and twenty is not at all infrequent.

6. Greater attention to this problem will result in earlier diagnosis and better treatment.

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CONVULSIONS DURING INHALATION ANESTHESIA

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CONVULSIONS during inhalation anesthesia are one of the most disconcerting complications which a surgeon encounters. They are also one of the most serious complications since the mortality rate may be as high as 20 per cent.[1] They are not very common although like many supposedly rare conditions there has been a considerable apparent increase in the number of cases since the initial reports of the condition in 1927.[2–4] Whenever they do occur the responsible surgeon as well as the anesthetist is always unhappy to be unacquainted and unprepared to meet the situation.

SURGICAL ASPECTS

A study of surgical literature is rather disappointing but certain interesting facts are apparent. At first they were designated "ether convulsions"[5,6] but apparently all of the inhalation anesthetics have induced convulsions on occasion.[7] We were unable to find any report of a typical convulsion during intravenous barbiturate anesthesia.[8] Preoperative medication with barbiturates has failed to prevent the convulsion[9] although it is reasonable to expect them to have some prophylactic effect.[10]

In one instance[11] a patient had a four-minute convulsion during ether anesthesia which ceased spontaneously and the operation as well as the same anesthetic were continued uneventfully. In another instance a patient had a convulsion during ether anesthesia and a few days later had a second more serious and longer operation under ether without recurrence of the convulsions.[12] The same anesthetic solution and apparatus which were used when the convulsions occurred have been immediately used on another patient without convulsions developing.[1] Tests for significant impurities and toxicity of the ether used have been invariably negative.[13] No cases in elderly people have been reported.[14] Many of the reported cases have been young females with a septic condition and fever, typically acute febrile appendicitis.[15]

One young patient had a convulsion during ether anesthesia for an application of a cast to a fractured os calcis, i.e., no operation was performed. Three weeks later an exploration of the bone under ether was uneventful.[16] Another child had a convulsion during ether anesthesia for an osteotomy for congenital dislocation of the hips. Six months later she had an uneventful nitrous-oxide-ethylene anesthesia for a second osteotomy. Two weeks after the second operation a brief nitrous-oxide anesthesia was associated with tetanic contractions. A few days later without anesthesia an increase in traction of the legs precipitated four generalized convulsions.[17] One surgeon reported two patients who had repeated operations and repeated convulsions.[18] Complete recovery is the rule but severe degrees of mental impairment or paralysis may follow.[19] A high fever (106°F.) has been noted in a number of subjects but hyperpyrexia is a common feature of the convulsive state and therefore is not necessarily an etiological factor. The convulsions have occurred early during anesthesia and also after discontinuance but have most commonly developed late in a prolonged anesthesia.[20] Vinesthene seems to be the worst offender,[21] one report stating that the nurses in the recovery ward came to regard the convulsions as an unimportant normal complication.[10] The mortality rate increases with the duration and severity of the convulsions. It has been suggested that the convulsions are Jacksonion in type beginning with a twitching of the facial muscles.[22] This seems questionable since they have not been described as starting in any other part of the body.

The apparent origin in the facial area is probably explained by the fact that the face is the only part of the anesthetized patient which is under careful observation.[23] Alert surgeons have warned of the imminence of convulsions by the pushing up of the intestines during laporatomy. No prodromal features such as difficulty of induction, etc., have been described as useful warning signals.

NEUROLOGICAL ASPECTS

The neurological literature was more informative although not much was specifically found concerning convulsions during anesthesia.[27] Neurologists plainly state that which is apparent from a study of the surgical literature, that the cause and nature of the convulsive state is not known. Thus it may be said that until some rational explanation is offered as to why and how an epileptic person may have a convulsion while walking down the street, apparently in otherwise perfect health, it will be difficult to explain convulsions during anesthesia. However, certain features of the convulsive state are known and may have practical bearing on the surgical problem.

Electroencephalography has shown that approximately 12 per cent of the population have significant electrical action current waves similar to those found in about 75 per cent of epiletics.[23] A group of twenty-two patients who had had convulsions under anesthesia also showed 73 per cent to have similar abnormal waves. A study of a group of patients with puerperal toxemia showed the eclamptics to have a similar high rate of abnormal waves in comparison with the so-called pre-eclamptics who did not have frank convulsions.[28] Individuals with such abnormal electroencephalographic waves are presumably more susceptible to convulsions from whatever excitants. There is great individual variation in susceptibility to the dose of convulsive drugs such as absinthe, insulin, metrazol and electric shock.[29] Some people who faint develop convulsions if not allowed to promptly attain a horizontal position. This is probably a manifestation of the convulsive effect of anoxia. The hypocalcemia of the alkalosis of hyperventilation produces tetany which may predispose to convulsions. The delirium of fever attains convulsive vigor in some persons, especially in infancy.

ETIOLOGICAL THEORY

Many reasons have been advanced as to the cause of convulsions during inhalation anesthesia.[24] Most of these so-called causes do not deserve repetition here. Many of them are patently absurd, obviously concomitant variations, unprovable theories or at least subject to the Scotch verdict "not proven." Coincidental idiopathic epilepsy can not explain many of the cases since a history of epilepsy is rarely obtained. When unsedated epileptics have one of their fits during anesthesia it is usually during the induction stage.[25] Rosenow's theory of the fortuitous coexistence of a subclinical infection with a streptococcus of strong neurotropic propensities cannot be disproven and probably explains some cases. There seems to be no single factor or combination of factors invariable enough to qualify as the cause of the convulsions except the salient fact of the inhalation anesthetic. Similarly there seems to be no specific precaution to be taken against the convulsions other than the fact that the patient should be given the benefit of good surgical judgment in all respects.

Whether considered a constitutional predisposition or by whatever name designated, it seems established that some people have convulsions more easily than others. If these people could be positively identified preoperatively the anesthetist and surgeon might be forewarned. Electroencephalography is not an accurate determiner and a history of convulsions is not often found. It is even better established that certain states of pathological physiology can sometimes induce convulsions. Among these are alkalosis, anoxemia, hyperpyrexia, azotemia and intoxication from certain drugs known as convulsants.

We suggest that the inhalation anesthetics should be considered as weak facultative convulsants. Divinyl ether (vinesthene) is a considerably stronger convulsant than the ordinary di-ethyl ether. They are such weak convulsants that only in certain predisposed individuals under certain contributing irritative conditions can they produce convulsions. To consider ether as a convulsant is contrary to ordinary concepts but seems justified. Metrazol (pentamethylentetrazol) is perhaps an analogous drug. Originally introduced as a central stimulant for respiratory and circulatory support in emergencies there came a time when it was particularly used as a convulsant in treating psychoses. Convulsions under anesthesia, therefore, may be determined in a small part by a predisposition of the individual and by certain known aggravating factors, including a weakly convulsant drug, but in greater part they are determined by the same unknown factors of cause and nature common to the convulsive state in general.

THERAPY

The therapy for convulsions when they appear is directed primarily at the palliation of the convulsions.[30] The convulsion state is dangerous.[31] The act of respiration is suspended during the convulsions with consequent anoxia and cyanosis of severe degree. A vicious circle is instituted because anoxia of the brain predisposes to convulsions. The convulsive dose of absinthe for instance is less when the animal is cyanotic. The nervous tissue of the brain is easily injured by anoxia and permanent damage may be produced. The convulsions are best controlled by the intravenous barbiturate anesthetic sodium pentothal. As soon as a convulsion occurs the inhalation anesthetic should be discontinued, oxygen administered by the anesthetic machine and a solution of sodium pentothal injected intravenously. The dose is the amount necessary to control the convulsion. As little as 10 cc. of 2.5 per cent solution has been successful[30] but larger doses may be necessary. Intratracheal intubation should be done so that artificial respiration can be maintained. The operation should be concluded as soon as practical, closing the abdomen simply with several through-and-through stay sutures for instance; if the convulsions persist their violence can be reduced by intocostrin. It should be remembered that the dose of intocostrin is much less in the presence of ether anesthesia. The hyperpyrexia should be reduced by cold compresses. General supportive measures may be indicated for shock such as intravenous fluids and vitamins. Oxygen may be given by tent or mask for some time after the convulsions have ceased. Death has resulted from late pulmonary complications[32] so bronchial aspiration through the bronchoscope and prophylactic penicillin may be desirable.

CASE REPORTS

Case I. The first of these has been reported by Tovell[33] (Case III) and was not a severe generalized convulsion but rather a muscular jerking which so alarmed the surgeon that operation was postponed.

Case II. The second case was a young girl with acute febrile appendicitis. The convulsions occurred while the abdomen was being closed and responded promptly to intravenous sodium amytal. The postoperative course was quite normal. The anesthetic had been induced by an experienced nurse anesthetist with a nitrous-oxide and oxygen mixture and maintained smoothly with ether and oxygen on a Lundy-Heidbrink machine with a carbon-dioxide absorber. Preliminary medication had been pentobarbital, morphine and atrophine.

Case III. This case was a twenty-three year year old muscular, male negro with a small old afebrile appendiceal abscess. The convulsions appeared after approximately twenty-five minutes of anesthesia. The patient had taken the anesthetic very poorly and the inexperienced nurse anesthetist had resorted to an open ether mask. Preliminary medication was pentobarbital, morphine and atropine. The operation was performed in the evening; the convulsions were brief but violent and the patient promptly died. There was some question of the death

being simply a matter of an overdose of ether but the convulsion was the significant intermediate event. Necropsy permission was denied.

Case IV. Mrs. F. W., aged twenty-three, white, a housewife dependent of a soldier. She entered the hospital on July 8, 1943 at 3:00 A.M., complaining of abdominal pain of forty-eight hours duration. The pain was severe and the patient was nauseated. The past history contained no serious illnesses, operations or injuries of note. A recent pregnancy had produced a healthy boy now nine months old for whom the breasts were still lactating. There was no familial or past history of allergy, convulsions or drug idiosyncrasies. On admission the temperature was normal. There was localized tenderness and guarding in the right lower quadrant of the abdomen. The blood pressure was 130 mm. of mercury systolic and 74 diastolic. The patient said she was 63 inches in height and weighed 145 lbs. She was bright and intelligently cooperative. The laboratory reported a negative urinalysis with a specific gravity of 1.032. The blood showed 10.9 Gm. of hemoglobin per 100 cc. with 3,500,000 erythrocytes per cu. mm. No explanation for this anemia was apparent. The leukocytes were 12,050 per cu. mm. and 90 per cent polymorphonuclears.

By 8:00 A.M. the fever had risen to 100.2°F., with a pulse rate of 90 per minute; a diagnosis of acute appendicitis was made. The anesthetic for appendectomy was started at 9:00 A.M. Preliminary medication was morphine sulfate 10 mg. and atropine sulfate .15 mg. given about 8:45 A.M. The anesthetic was induced by an experienced nurse anesthetist with a nitrous-oxide and oxygen mixture on a Lundy-Heidbrink machine, switching soon to ether vapor in oxygen with a carbon-dioxide absorber. The anesthetic was accepted well and the patient was quite relaxed.

The operation was very difficult. The appendix was completely retrocecal and gangrenous. After approximately sixty minutes of anesthesia the patient suddenly had a severe generalized convulsion of variable intensity lasting thirty minutes. The temperature rose to 106.2°F. by axilla. Cyanosis was often deep in spite of discontinuing the ether and supplying pure oxygen. The operation was promptly terminated with a drain through a stab wound in the flank. Shock developed with the blood pressure falling to 60 systolic and 0 diastolic, the pulse was 150 and the respiratory rate 34. No intravenous barbiturate solution was available. Supportive therapy was applied, 500 cc. of preserved plasma and 1,000 cc. of 10 per cent glucose in normal saline solution intravenously and caffeine and adrenalin were given. The patient was returned to her bed at 10:45 A.M.; oxygen was continued by B. L. B. mask and ice bags were applied to the limbs. She vomited at 11:45 A.M. and the anesthetist's airway could be removed. Her temperature had fallen to 101°F. rectally with pulse of 136, respiration 36 and blood pressure 110/75. She continued to have epileptiform convulsions every few minutes lasting for one-half to eleven minutes. These convulsions might occur spontaneously or be precipitated by minor stimuli such as a mere touch of the nurse's hand. She was incontinent; the breathing was deep and heavy suggesting acidosis so insulin and glucose were given intravenously. At 6:00 P.M. 3 gr. of sodium phenobarbital were given intravenously. Following this she was quieter and the pulse slowed to 88 but the respiration remained at a rapid 30 and she continued to have convulsions every half-hour lasting for several minutes.

At 1:00 A.M. of the first postoperative day she started to move her arms and legs and began to groan occasionally. All reflexes were very hyperactive with opisthnotonus. Urine examination showed a specific gravity of 1.020 with albumin grade 3 (on the basis of 4), sugar grade 4 (due to intravenous glucose?) acetone and diacetic acid grade 3, an occasional granular cast and leukocyte but no blood. Blood chlorides were 560 mg. per cent and nonprotein nitrogen was 43 (both slightly elevated). Phenobarbital was given repeatedly in 3 gr. doses intramuscularly but the convulsions continued to recur at longer intervals and less violently. The spinal fluid was under normal pressure and contained no blood but the total protein was 65 mg. per cent. The blood sugar was 105 mg. Thirty hours after the operation her general condition seemed improved although her temperature was 102°F. The pulse varied from 100 to 150 and the respirations 38 to 50. The pupils were dilated but equal and reacted to light. The fundi appeared normal. The reflexes continued to be hyperactive but were equal on the two sides. Muscular rigidity

and twitching were notable even between convulsions.

During the second postoperative day her condition continued to be serious although the convulsions ceased in about forty hours. The fever persisted at 102°F., the pulse ranged from 120 to 140 and the respirations were 40 to 48. The reflexes changed to hypoactive and the pupils did not respond to light. She vomited several times and opisthnotonus was still noted when the nurses moved her. Calcium gluconate was given intravenously without evident effect. Thiamine hydrochloride was started, 100 mg. intramuscularly three times a day. She developed a slight cough so carbon dioxide inhalations were given every four hours.

By the end of the first postoperative week she had improved somewhat. She moved her arms and legs and began responding to simple nursing instructions. She recognized her husband on the sixth day. Sustenance was maintained by intravenous solutions in large quantities. She did not speak and had difficulty in raising sputum. The fever continued at about 102°F. There was considerable purulent discharge around the surgical drain.

During the second postoperative week she began to accept nourishment by mouth. Sulfadiazine was given to maintain a blood level of 12 mg. per cent. There was still a tendency to opisthnotonus and she was aphasic. She would smile and grimace on instruction and cooperated fairly well at times; at other times she would become restless, agitated and negativistic. She was not distended at any time. A fever of 102°F. continued with commensurate pulse and respiration. Purulent drainage continued from the drainage wound and the incision also began to drain. She had difficulty in swallowing sulfadiazine tablets.

During the third postoperative week a disuse contracture of the right arm was noticed. Extension was limited to 145 degrees. Her fever continued a septic course rising to 102°F. at which time she would become delirious and incontinent. At times she would babble incoherently for an hour or so; at other times she would ask intelligently for attention and seemed quite well oriented. She was able to speak a few words slowly with great difficulty. The difficulty in swallowing continued as did the cough. Several transfusions of citrated blood were given.

During the fourth week the right colic gutter was explored through a flank incision under local infiltration anesthesia with procaine and a large abscess was drained. The fever promptly subsided and her mental status improved considerably. She still had difficulty in speaking and swallowing and the cough persisted. The speech impairment seemed to be a groping for words as if there were some interruption in the speech pathways in the brain, although it was found she had a symmetrical paralysis of the palate which explained her difficulty in swallowing and dysphonia. The tongue was also partially paralyzed. She could work crossword puzzles with celerity; she had been adept at this before her convulsions.

During the second month of hospitalization her mental faculties cleared nicely. The wounds continued to drain but finally closed. A fecal fistula was evidently present for a short time. Her pharyngeal paralysis persisted and it was thought that her irritative cough was due to inhaling pharyngeal mucus. There was no headache. The contracture of the right arm (biceps) improved but extension was still incomplete. With excitement she became quite incoherent but when she spoke slowly and carefully her speech seemed quite normal. She was dismissed from the hospital on August 30, 1943.

She reported by letter nine months later that the contracture of the arm had completely disappeared. She spoke quite normally but still had some difficulty in swallowing. She did not have any significant headache. Apparently there had been no change in her personality.

COMMENT

The failure of phenobarbital to completely relieve the convulsions was a disappointing feature of the case. It is possible that larger doses would have been more effective.

CONCLUSIONS

1. The fundamental nature and cause of convulsions is unknown both during and without inhalation anesthesia.

2. It is suggested that the drugs used for inhalation anesthesia should be regarded as weak facultative convulsants which

precipitate convulsions in certain predisposed individuals.

3. Probably the most effective prophylactic is the use of a barbiturate as preoperative medication.

4. Treatment of the convulsion is also probably best accomplished by intravenous barbiturate (sodium pentothal) anesthesia and general supportive measures.

5. A case is presented with residual glossopharyngeal paralysis.

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THE UNDERDEVELOPED CHIN

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IN a previous article[1] sixteen cases of preserved rib cartilage chin implantations were reported; since then, an additional fifteen transplantations were performed. It is the purpose of this paper to supplement the previous report.

Plastic surgeons will agree that the majority of patients with receded chins seek consultation for nasal correction. In the course of examination, the surgeon examines not only the patients' nose but also the other facial features and the general stature. A critical survey is made. The forehead, nasofrontal angle, nasal projection, nasolabial angle, superior maxilla, dental projection and chin are observed. Individual analysis is made as each face is a unique one. The patient is observed in the relaxed, smiling, laughing and speaking positions. One searches for defects and singles out those facial characteristics which are not in proportion. One or more malfeatures may be present and may or may not lend themselves to satisfactory esthetic correction. With the exception of the nose, deformities of the chin are the most common facial malformation.

A chin which appears to be underdeveloped requires careful study before a true diagnosis of microgenia is established. Frequently a micrognathic appearing lower jaw is not receded. It may appear small but this may only be an apparition, especially if the upper teeth are "bucked" or protrude too far in advance of the lower jaw. A chin is underdeveloped only when it is out of proportion with the other facial features.

The nose plays an important rôle in chin corrections. A prominent nose with a webbed nasolabial angle can create a small lower jaw illusion. A humped or long nose may accentuate a minor chin recession. The mere lifting of a nasal tip can remove the emphasis from a mildly protruded or receded chin. In certain instances, the "mouth breather" appearance is eliminated by reducing the nasal profile and elevating the nasal tip without chin correction.

Occasionally where a prominent long nose and apparent receded chin are present concomitantly, one is uncertain prior to operation whether or not a chin correction is necessary. At operation, the nose is first corrected and then the chin if deemed necessary.

CLASSIFICATION OF THE UNDERDEVELOPED CHIN

From a didactic point of view, hypoplastic chins may be classified in five types: (1) Underdeveloped in a superior to inferior direction due to decreased height of the body of the mandible or absence or recession of the lower teeth; (2) underdeveloped in a lateral to lateral direction due to decreased width of the body of the mandible; (3) underdeveloped in an anterior to posterior direction due to dwarfing of the mental protuberance, absence of the mental tubercles, shortening of the horizontal rami or a posterior dislocation of the temporomandibular joints; (4) underdeveloped unilaterally due to a unilateral first branchial arch and cleft malformation or a unilateral dislocation of the temporomandibular joint, and (5) underdeveloped in a combination of two or more of the above.

From a surgical point of view, three types of chin recessions are noted depending upon their degree.

1. *Mildly Receded.* If the nose and other facial features are in proportion, a chin correction may not be necessary. If

FIG. 1. A and B, preoperative photographs; C and D, postoperative photographs after combined rhinoplasty and thin preserved rib cartilage chin implantation.

the nose is prominent, hooked or long, nasal correction combined with a thin preserved rib cartilage chin implant may be indicated. (Fig. 1.)

2. *Moderately Receded.* The lower teeth are usually receded giving a "buck tooth" appearance. The deformity is accentuated when smiling or laughing. The patients are self-conscious and employ compensatory cover-up mechanisms such as hiding the face with the hands or turning away while expressing their emotions. During childhood, orthodontics is the method of treatment. After puberty, if esthetic improvement is desired, a thick preserved rib cartilage graft may be inserted into the chin to bring the glabella and mentum into a perpendicular line. (Figs. 2 and 3.)

3. *Markedly Receded.* This exaggerated deformity gives a comical expression to the face. Stage and movie comedians and circus clowns often burlesque it. Masks and false

FIG. 2. A and B, preoperative photographs; C and D, postoperative photographs after combined rhinoplasty and thick preserved rib cartilage chin implantation.

faces used at parties and Mardi Gras imitate it. The patient suffers repeated cruel ridicule. To improve the appearance and dental occlusion simultaneously, an osteotomy through the horizontal ramus with advancement of the lower jaw may be performed. Satisfactory esthetic improvement may be obtained by the mere insertion of one or more thick preserved rib cartilage grafts. (Figs. 4 and 5.)

Age. Medical men tend to discourage their patients from esthetic facial corrections until they are eighteen years of age or over. A careful study of adolescents will show that the majority of girls are fully developed between the ages of thirteen and fourteen; the breasts are full grown, the ovaries are functioning and the secondary sex characteristics are complete. The final adult facies is attained at the same age.

This period is the ideal time for facial plastic surgery as one need not fear further changes of the facial characteristics. The patients can well tolerate the surgery and make excellent and rapid recoveries. At this age most girls begin secondary school. If a facial deformity is present

A B

FIG. 3. A, preoperative photograph; B, postoperative photograph after combined rhinoplasty and thick preserved rib cartilage chin implantation.

which the patient wishes corrected, the operation should not be denied. It should be performed before entering the new school and beginning a new phase of life.

Boys mature at a later age. Their facial features are not fully developed until the ages of fifteen or sixteen. Should one be in doubt, procrastination is best. However, when the features appear to be developed, considering the body as a whole, the operation should not be delayed.

TECHNIC

Of all the various procedures in plastic surgery, the preserved cartilage transplant for a receded chin is perhaps the most

A B

FIG. 4. A, preoperative photograph; B, postoperative photograph after combined rhinoplasty and thick preserved rib cartilage chin implantation.

Fig. 5. A and B, preoperative photographs; C and D, postoperative photographs after combined rhinoplasty and very thick preserved rib cartilage chin implantation.

simple, most rapidly performed and most gratifying of all operations. Preserved cartilage is readily obtainable in large quantities; it is kept in readiness in a sterile solution and is easy to model. Foreign body reactions from preserved cartilage implanted into the chin are a rarity.

In most instances, a rhinoplasty is performed concomitantly with the chin plastic. The nose is first corrected and strapped in position; a cast is not applied to the nose so that all the facial components may be freely visible for the chin correction. The gowns, drapes and gloves are changed; the face, chin and neck are again surgically prepared; another set of sterile instruments is employed; guide lines are drawn. The cartilage is modeled to size, all sharp corners being beveled. The anterior surface may be flat as the mentum pad maintains the graceful fullness of the

chin. Procaine with suprarenin is injected and the cartilage inserted through a small submental incision. The incision is closed and a firm pressure dressing is applied. A cast is then modeled to the nose.

The pressure bandage is removed from the chin on the fifth day; upon removal, the chin is insensitive and appears too large. The swelling, however, rapidly recedes. The sensitivity begins to return after a month and is usually complete after three months.

COMPLICATIONS

Failures or untoward results after preserved rib cartilage chin transplantations are not common. Certain complications, however, may take place

1. *Perforation into the Oral Cavity.* This may occur in the course of undermining the skin over the mentum. If this happens, the submental incision may be closed and the operation terminated. It may then be repeated a month later. However, the cartilage may be implanted even after oral perforation if penicillin is administered concomitantly. Infection does not usually occur.

2. *Displacement of the Graft.* This may occur if a tight immobilization bandage is not applied; it occasionally takes place despite it. Extensive undermining or an accidental blow before the cartilage is firmly fixed can displace the graft. A secondary operation is then necessary. The cartilage is liberated and replaced in its proper position.

3. *Infection.* Infections from preserved rib cartilage chin transplants are not common. They occur more frequently after autogenous transplantation of the nasal hump or septal cartilage and bone. In this series, one mild infection occurred which healed spontaneously in a few days without specific treatment.

4. *Vesicular Dermatitis.* This is quite commonly found on the skin of the chin after the removal of the pressure dressing. Specific treatment is unnecessary as the vesicles disappear in a few weeks.

COMMENTS

The microgenic chin is a common facial deformity. Satisfactory esthetic results are obtained by preserved rib cartilage transplantation. The operation is simple, requires little skill and entails a minimum of risk.

Every individual with an underdeveloped chin who presents himself for nasal correction should have the merits of preserved rib cartilage chin correction explained. As a rule, patients with hypoplastic chins are frightened and reluctant to undergo chin correction, but they are not averse to the procedure after the rapidity and simplicity of the operation is explained.

If the facial features are in harmony, with the exception of a receded chin, preserved rib cartilage chin transplantation gives a satisfactory cosmetic result. If a nasal and chin plastic are performed concomitantly, the esthetic results are often spectacular. An unpleasant facial contour is transformed into a highly desirable one.

CONCLUSION

Preserved rib cartilage was transplanted into microgenic chins in thirty-one instances. In all save one the recovery was rapid, uneventful and gratifying. A single case of infection occurred but healed spontaneously in a few days without specific treatment.

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TOPICAL ANESTHESIA*

EFFECT ON TISSUE REGENERATION

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PHYSIOLOGISTS are generally agreed that there are certain prerequisites for normal repair of injured tissues. These are adequate amounts of ascorbic acid, equilibrium of serum proteins and normal carbohydrate metabolism. According to Holten and Crile, Jr., there is little evidence that a good physical condition and vitamins other than ascorbic acid are necessary.[1]

However, in recent years there have been indications that local anesthesia may play a significant part, especially where pain is a prominent factor. Leriche[2] believes that anesthesia is important since trauma initiates an excitation of nerve impulses along vasomotor afferent neurons which produce excessive vasodilatation, with edema, pain, tenderness and muscular spasm. If pain is eliminated there is, therefore, destruction of the impulses which emanate in autonomic waves from traumatized areas with a subsequent return of vasomotor tone, thus effecting normal autonomic equilibrium.

Cullumbine, Rice and others[3] have treated minor fractures with 1 or 2 per cent solutions of procaine hydrochloride injected into the fracture site. It was observed that better alignment of bones was obtainable under good local anesthesia, pain was promptly relieved, the patient was able to walk immediately in many instances and healing was rapid.

Excellent results have been reported[4] following single injections of similar solutions into sprained joints and torn ligaments. Most of the patients were able to use the injured joint immediately; only few required an additional injection. Apparently the procaine hydrochloride prevents the vasodilatation and edema responsible for pain and disability.

Rivaz-Diez and Delrio[5] discuss the use of local anesthetics in the therapy of burns. They use four methods: local anesthesia in small burns, nerve block in larger burns of the extremities, intravenous injections of procaine in extensive burns and intra-arterial injections of a procaine hydrochloride solution. They found that with diminution of circulatory congestion, edema and exudation, not only was the pain less intense but the rate of epithelization was accelerated.

It has been repeatedly demonstrated that chemicals are more potent cutaneous sensitizers when applied in concentrated solutions. Therefore, an ointment was used which contained less than 1 per cent of the para-aminobenzoates.[6] A small quantity of cod liver oil was added for its healing and analgesic properties.[7] Cod liver oil stimulates granulation tissue and its use is almost invariably followed by soft, supple cicatrices. Although some authors have attributed many of the benefits of the oil to its bacteriostatic action, Goertzen[8] has shown experimentally that it is not germicidal. He believes the healing effects of cod liver oil are due to its ability to protect the tissues against dehydration and to

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promote granulation tissue. The antiseptic properties of the ointment were enhanced by the presence of sodium propionate.[9]

Since burns and hypostatic ulcers offer the most convenient example of painful cutaneous lesions, and since both in many respects present identical chemopathological changes they were selected to determine the effects of a local anesthetic ointment on tissue regeneration.

In view of the possibility of cutaneous irritation from the aminobenzoates, sixty subjects were tested according to Federal Trade Commission recommendations (240 patches) for primary irritation and hyperallergization. Only one patient reacted positively to the ointment. Patch tests were done with the various ingredients and this patient was found to be sensitive to benzyl benzoate.

Procedure. One hundred three patients were treated; sixty-six had burns of varying degree. In no instance did the burn involve more than one-eighth of the body surface. Débridement was performed after cleansing the area with tincture of green soap prior to application of the ointment* and a sterile dressing. The patients were instructed to return to the clinic in twenty-four hours for observation. The outpatients were redressed twice weekly and hospitalized patients were dressed as necessary (one to three times weekly). All the patients treated for burns were comfortable and able to work throughout the treatment time.

* An ointment of the lipophilic type was used in this investigation and was designated "S. P. 901." Its composition was as follows:

Lanolin	25.
Petrolatum	25.
Water	15.
Iso-beeswax	8.
Cod liver oil	20.
Corn oil	5.
Amyl para-amino benzoate	0.7
Ethyl para-amino benzoate	0.2
Benzyl benzoate	1.
Sodium propionate	2.

This ointment was supplied by Chatham Pharmaceuticals, Inc., Newark, N. J. and corresponds to their product, Ultracain.

Thirty-one patients suffering from ulcers due to various causes were treated with the ointment, which was applied directly to the ulcer and any surrounding dermatitis. The dressings were changed once or twice weekly. If necessary, the individual was hospitalized. Patients with vascular insufficiency were encouraged to wear an elastic bandage.

TABLE 1

Type	No. of Patients Treated	Average No. of Treatment Days	Extremes
BURNS			
1st degree	15	4.0	2– 7 days
2nd degree	49	11.4	5–21 days
3rd degree	7	21.5	7–35 days
Mixed	5		
ULCERS			
Hypostatic	25	34	7–90 days
Traumatic	4	14	7–28 days
Pyogenic	1	42	
Sickle cell	1	no effect	

When the epidermis had completely regenerated, even in the presence of some erythema, the wound (burn or ulcer) was considered healed and no longer in need of topical therapy.

Results. Every patient reported relief of pain at the site of the burn or the ulcer immediately upon application of the ointment. We observed no infection during the course of treatment. The scars were soft and pliable with very little evidence of contracture even in third degree burns. No adverse reactions to the ointment were encountered when its use was restricted to denuded areas. The healing time impressed us as being unusually short. Table 1. Of the sixty-six patients treated for burns, only one developed a surrounding dermatitis. This patient was a child who was cared for at home in an unclean environment. Three patients with ulcers were irritated by the ointment; (one with a

hypostatic ulcer developed a vesicular dermatitis after the ulcer had healed; one patient complained of subjective discomfort but there was no evidence of dermatitis; the third patient developed a dermatitis on continued use of the ointment two months after the ulcer had healed). Patch tests with all ingredients were negative in these patients.

COMMENTS

It is important to note that the aminobenzoates present in a concentration of 0.9 per cent were able to produce immediate and adequate topical anesthesia. Most previous reports dealing with the use of para-aminobenzoates as topical anesthetic agents were based on the use of solutions or ointments containing more than 2 per cent of these drugs.

In this series of 103 patients, there were no infected wounds (burns or ulcers) during the treatment period, although many of the burns were not seen until several days after their occurrence. These were treated as fresh burns; cleansed thoroughly with green soap and followed by a sterile dressing of ointment. The inhibition of bacterial growth by the ointment no doubt was responsible to a large extent for the relatively short healing time.

First degree burns, where only the epidermis was damaged, healed in two to seven days, depending upon the extent of the injury. Second degree burns showed signs of epithelization as early as five days after treatment was started. In the deeper burns and ulcers, epithelization was more rapid peripherally than centrally. The longest healing time was thirty-five days, except in one patient whose burn was severe and extensive, including the entire anterior tibial region and knee. The area involved to secondary degree was healed within thirty-five days, whereas the more deeply burned area around the knee was just about to epithelize at this time. Pinch grafts were then applied, the resulting scar being soft and supple.

Only four of 103 patients developed a dermatitis, all of them having continued use of the ointment after the ulcer or burn had healed. These patients were patch tested to each ingredient of the ointment and reacted negatively to all. No dermatitis developed during treatment while the area was denuded.

SUMMARY

1. Many investigators have shown that anesthesia plays a significant part in the promotion of healing.

2. Sixty-six patients with burns and thirty-one patients with ulcers were treated with an ointment containing less than 1 per cent of aminobenzoates.

3. Healing was rapid and scars soft and supple.

4. No infection was observed during treatment.

5. No irritation occurred regardless of the length of time that the ointment was used on the broken skin.

6. Of the 103 patients treated and 240 patch tests, no cases of benzocaine sensitivity were seen.

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Many minor operations in the mouth can be performed under local anesthesia, but if the operation is expected to occupy some length of time and bleeding to be free it is wiser to give a general anaesthetic, preferably with the introduction of an intratracheal catheter.

From "Minor Surgery" edited by Humphry Rolleston and Allan Moncrieff (Philosophical Library).

ABDOMINAL SYMPTOMS IN SUDDEN ACUTE HEART CONDITIONS

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THE occurrence of abdominal symptoms in sudden, acute coronary conditions is known to all, but its incidence is not always appreciated. Whereas the signs and symptoms of typical acute heart disease and typical abdominal pathological conditions offer little difficulty in differential diagnosis, a number of borderline cases occur in which the correct diagnosis is seriously in doubt, often for a matter of hours, and even completely missed.

Since immediate lines of treatment are indicated in both sudden, acute heart conditions and acute abdominal disease, a discussion of the pathologic physiology and some of the diagnostic aids of these situations is valuable.

The subject of abdominal and thoracic viscus pain has been discussed thoroughly since the turn of the century. Of these two entities abdominal pain perhaps has been most written about due to greater surgical opportunities to make observations in this area of the body. While the works of Ross,[1] Lennander,[2] MacKenzie[3] and Hurst[4] do not agree entirely on whether or not visceral pain originates in the somatic nerve terminals of the parietal peritoneum or the bowel, or whether all visceral pain is of the referred type, it has been generally accepted that in whatever form this pain exists, it is carried by the afferent fibers of the splanchnic nerves. Phenomena such as nausea and feelings of tension are the sensory properties of the vagus and its branches.

The same differentiation holds true for the sensory impulses of the heart. Pain is carried by afferent fibers of the superior, middle and inferior cardiac nerves and not the vagus.

The anatomy of the splanchnic and cardiac nerves have many features in common.[5] They are both derived from lateral horn cells (intermediolateral cell column) of the spinal cord and are associated with outlying ganglia which comprise the sympathetic system. Efferent fibers of this system are preganglionic, medullated fibers which synapse in vertebral ganglia and emerge as postganglionic unmedullated fibers. The afferent fibers accompany almost in full accord, as to anatomical relation, their motor counterpart. Thus they enter the cord at the same level that the efferent fibers of their respective organs left. The afferent fibers arising directly in the organ have their cell body in the posterior root and have their synapse in the grey matter of the cord and ascend for the main part in dorsolateral fasciculus or tract of Lissauer.

The superior, middle and inferior cardiac nerves are derived from the corresponding cervical ganglion but their cells of origin for their preganglionic fibers arise in the upper four or five thoracic segments of the cord. There are three divisions of the splanchnic nerves: greater, lesser and least, so named after their respective size. The greater splanchnic in some individuals can arise from the cord as high as the fourth or fifth thoracic segment.[6] The other two splanchnics arise down to the eleventh thoracic segments.

Thus it is evident that pain sensations from two unrelated systems as the heart and upper abdominal contents can bombard the spinal cord in two complete and identical segments.

As stated before, most observers agree that nausea and vomiting are the result of afferent vagus impulses ending in the dorsal nucleus. The anatomy of the vagus nerve is familiar to all, namely, that of an elongated main stem extending from the fourth ventricle through the neck and

thorax, ending in the mid-abdomen. Branch divisions to the heart and the abdominal viscus arise from this main stem. It is certainly not difficult to conceive of a sudden, overwhelming stimulus occurring in the heart irritating abdominal fibers

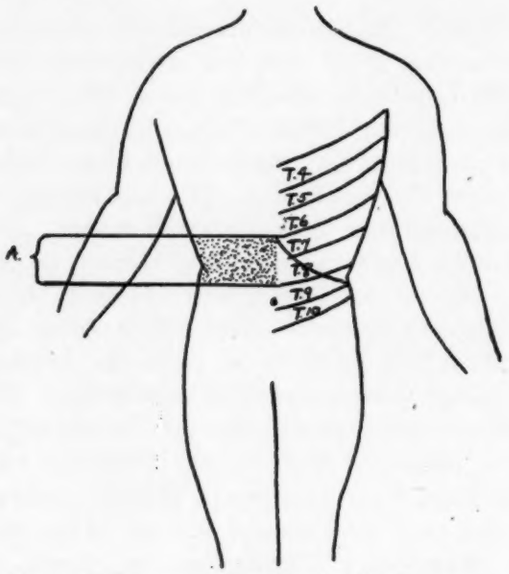

Fig. 1. Dermatomes of the human body; anterior aspect.

contained in the same nerve stem with those cardiac fibers for which the stimulus was intended.

In addition to deep pain, nausea and vomiting occurring as abdominal manifestations of acute cardiac conditions, signs of actual muscular rigidity and peripheral hyperesthesia are encountered in some cases. Assuming the theory of Mackenzie or viscero-sensory reflexes is correct (it is not the purpose of this paper to prove or disprove the subject of referred pain), the work of Head[7] explains these misplaced phenomena. The basis of his work is the embryological development of the dermatome and the fact that a given spinal segment supplies a visceral area and a well delineated peripheral area. Of these foundations, he ingeniously mapped out the possible spinal segmental distribution of cutaneous nerves causing referred peripheral signs from near and distant visceral disturbances. He has shown that signs and symptoms originating in the heart are generally referred to the spinal segments supplied by the third to the fifth cervical and the higher thoracic; but they may be also referred as low as the eighth thoracic. As for the abdominal viscera, Head states that referrals from the stomach occur from the seventh or eighth thoracic; referrals from the liver, the eighth to the tenth thoracic, and the gallbladder refers signs and symptoms to the areas supplied from the fifth to the ninth thoracic. (Fig. 1.)

Figure 1 illustrates the peripheral area (dotted) in which referrals can occur from the heart, gallbladder, stomach and liver. Again we see an overlapping of the nervous mechanism responsible for the severity and location of signs and symptoms in disease.

Ninety-two cases which were admitted to the Memorial Hospital, Albany, New York, were reviewed. These admissions occurred from January, 1942, to January, 1946; ninety-one of these cases had a final diagnosis of coronary thrombosis and one case had a diagnosis of ruptured aortic aneurysm. One selected case admitted to the Albany Hospital in 1945 was used for illustration but this case was not used in any calculations. The youngest patient was thirty-six years old and the oldest was eighty-four. There were seventy-three males and nineteen females. The overall mortality of the group was forty-nine or a mortality rate of 53.3 per cent. The greatest number of cases occurred in the age group fifty to fifty-nine, where there were thirty-eight or a percentage of 41.3 per cent of the total. The highest mortality rate with respect to age occurred in the age group eighty to eighty-nine but since only one case was reported in this decade and only five in the seventy to seventy-nine group, the most significant mortality rate can be said to have occurred between the ages of sixty to sixty-nine, where twenty-eight cases were reported and twenty-one died, producing a mortality rate of 75.0 per cent. The mortality rate for females was 63.2 per cent as compared to 50.7 per cent for the males.

Table 1 compares the cases as to their age groups and their mortality rates with re-

spect to age. Table II compares sex and the mortality rate in reference to sex.

A study of the cases for abdominal symptoms reveals some interesting data. The group was investigated in the following manner: those who had abdominal

TABLE I

Age	30–39	40–49	50–59	60–69	70–79	80–89
No. of cases	4	16	38	28	5	1
Per cent of cases	4.35	17.39	41.30	30.435	5.435	1.09
Mortality	2	5	16	21	4	1
Mortality, per cent	50.00	31.25	42.11	75.00	80.00	100.00

TABLE II

Sex	Males	Females
Number	73	19
Per cent	19.35	20.65
Mortality	37	12
Mortality, per cent	50.68	63.16

TABLE III

Symptoms	No.	Per Cent	Mortality	Per Cent
Abdominal symptoms	20	21.74	14	70.00
Pain only	7	7.61	6	85.71
Nausea and vomiting only	6	6.52	4	66.67
Pain, nausea and vomiting	7	7.61	4	57.14
No other symptoms other than abdominal	11	11.96	8	72.73

symptoms, those whose abdominal symptoms consisted only of nausea and vomiting, those who had pain, nausea and vomiting and those whose abdominal symptoms were the sole symptoms of their disease; 21.8 per cent of the total cases studied had abdominal symptoms of which pain, nausea and vomiting occurred in about the same frequency. In 11.9 per cent of the group, abdominal symptoms comprised the only symptom of the patient's underlying condition. It is interesting to note that the mortality rate of the cases in which abdominal symptoms occurred was 70.0 per cent, which is well above the mortality rate of 53.3 per cent for the entire series. Table III illustrates the above data.

CASE REPORTS

CASE 1. L. B., a fifty year old white male dairy farmer, was admitted to Memorial Hospital on January 12, 1946, with a chief complaint of acute pain in the mid-abdomen. One hour before admission, the patient was seized with a severe pain in the abdomen which was sudden in onset. The pain was accompanied with nausea and vomiting and observers reported that questionable hematemesis had occurred. The pain was located between the epigastric lower area and the umbilicus and was in the midline. The bowels did not move on the day of admission but were normal previously. The patient could not state whether or not tarry stools had occurred. The patient stated that he had been bothered for the past six months with "stomach trouble" but no positive history of heartburn, sour stomach or pain could be obtained.

The patient had not had any medical contact for twenty years previous. He claimed perfect health and had no shortness of breath or chest pain. (It was later determined that this patient had been rejected for employment one year previous because of high blood pressure.)

Physical examination revealed the temperature to be 98°F., the pulse 70, and the blood pressure 120/70. He was a stocky, middle-aged male in much distress, alert and conscious. Examination of the head revealed nothing abnormal. There was no percussion dullness in the chest, breath sounds were normal and no râles were heard. The heart was not enlarged to percussion; its rhythm and rate were regular. There was a soft systolic murmur at the apex not well transmitted.

The abdomen was obese and muscular rigidity could not be well determined, but no marked spasm was present. There was tenderness over the entire abdomen but it was most pronounced just above the umbilicus. Rectal examination revealed nothing unusual. Reflexes were illicited in the extremities.

The white blood count was 7,500 with the Schilling index slightly to the left. The urine was negative. Serum amylase was 75 dextrose equivalents. An electrocardiogram was not taken.

One hour after admission, the patient appeared somewhat better. The pain had lessened

and was localizing in the right upper quadrant. The pulse rose to 86 and the blood pressure rose to 140/80. A provisional diagnosis of gallbladder colic was made. Four hours after admission, the pulse rose to 98 and the blood pressure was 150/60. The pain remained in the right upper quadrant, but the patient's general condition was much improved and he was allowed morphine gr. ⅙ and fluids. Shortly after this he complained of a tightness in his chest but this did not remain. Six hours after admission he suddenly became cyanotic and pulseless and expired while efforts were being made to institute oxygen.

Postmortem examination revealed a ruptured aneurysm of the ascending aorta, hemopericardium and cardiac temponade. Examination of the abdomen revealed no pathological condition.

Case II. J. G., a thirty-four year old white male was admitted to Albany Hospital, February 25, 1945, with a chief complaint of agonizing pain in the epigastrium. Two hours before admission, this patient was seized with a severe pain in his upper abdomen. Twenty-four hours prior to admission, the patient had a mild pain in the left shoulder but was perfectly well until the chief complaint occurred. There was a history of mild nausea and vomiting just before and during the onset of the pain. There were no complaints of previous chest pain. The patient was known to have a peptic ulcer and had had several exacerbations recently.

Physical examination revealed the temperature to be 99°F., the pulse 90, and the blood pressure 80/40. Examination of the head revealed nothing abnormal. Respirations were increased, but no râles were heard in the chest. The heart sounds were of good quality and the rhythm and rate were regular. There was a generalized spasm of the abdomen including both quadrants. The epigastric region was extremely tender to palpation.

The white blood count was 22,500 cells and the urine was negative. The electrocardiogram showed some myocardial damage to the posterior wall. *X*-ray of the abdomen for free air was negative.

Two hours after admission, the temperature rose to 100°F. and the white blood count rose to 35,000. The abdomen remained markedly spastic throughout, and the blood pressure and pulse remained unchanged. After a thorough medical and surgical consultation, a diagnosis of a ruptured ulcer was agreed upon because of the marked generalized abdominal rigidity, agonizing abdominal pain, markedly elevated and rising white blood count and rising temperature. An exploratory laporatomy was performed but no abdominal condition was found to explain the physical signs. On the first postoperative day, the patient's condition remained the same. The second day the temperature rose to 103°F. but the patient appeared somewhat improved. The blood pressure had risen to 90/65 and the breathing was not labored. Late that night, however, the patient suddenly had great difficulty in breathing, became cyanotic and expired.

Postmortem examination revealed a thrombosis of the right coronary artery, rupture of the posterior wall of the left ventricle, hemopericardium and a benign, duodenal, peptic ulcer.

DIAGNOSTIC AIDS

All agencies should be used in the differential diagnosis of an acute condition of the heart and abdomen. There is no single sign or test which can accurately place the disorder; rather a total evaluation of the avenues of information must be employed.

In some cases the patient is so moribund that an adequate history is not available. However, in those instances in which a history can be taken, a careful review should be made as to whether previous attacks of chest pain have occurred, whether there has been preceding shortness of breath, whether there have been attacks of heartburn, gas or abdominal distress associated with eating, and whether there have been tarry stools.

In the physical examination, aid can be given to differentiation. There has been too severe a stress laid on the rise in pulse rate in acute abdominal disorders. Unless hemorrhage occurs, there is usually little alteration in the pulse. Wagensteen[8] states, "even such a tragic occurrence as an acute perforation of a duodenal ulcer is not accompanied by material quickening of the pulse." This has been the writer's experience. Of course, later in an abdominal disorder, the behavior of the pulse is governed by changes and demands on the general body economy. In acute conditions of the heart, the pulse is more apt to

change, either in rate or in quality, often in both of these.

These same observations may be made for blood pressure. Substantial drops in arterial pressure are not usually seen in the early acute condition of the abdomen unless hemorrhage occurs. Later, when and if quickening of the pulse occurs, descending blood pressures may be recorded. A fall in the systolic pressure is much more apt to occur early in coronary occlusion, ruptured aneurysms, etc.

The electrocardiogram should always be utilized in diagnosis and the practice of postponing the electrocardiogram to include delayed changes in the tracing is to be condemned. The rate of appearance of pathological tracings is directly proportional to the rate of myocardial ischemia; and while changes in the electrocardiogram can take several days to develop, they can also appear in hours, minutes and even seconds.[9] Delay in obtaining an electrocardiographic record will postpone many early diagnoses of coronary occlusions; and since this procedure is harmless to the patient, it should be carried out immediately.

The white blood count is a dangerous index to employ but some conclusions can be cautiously drawn from it. A leukocytosis occurs in coronary thrombosis as well as in an acute condition of the abdomen but it can be generally said that the leukocytosis is seen earlier in the abdominal conditions and is apt to be higher in these states. The usual leukocyte rise in coronary thrombosis is between 10,000 to 15,000, but can be observed as high as 25,000.[10] Counts above this figure are not common. One feature of the white blood count which is significant, however, is a steady hourly rise in conjunction with the continuation of other abdominal symptoms. This very strongly points to abdominal disorders.

Fever is very similar to the white blood count in its significance. It can occur in both coronary and abdominal tragedies but its presence in coronary occlusion is generally restricted to rises of about 100°F. and the rise is usually later than in abdominal emergencies. Again, a steady rise in temperature in the absence of chest complications is significant in the diagnosis of acute abdominal disorders.

The use of roentgenography is to be encouraged as a diagnostic confirmation. Although many acute abdominal conditions produce a negative *x*-ray, the presence of gas in the free peritoneal cavity is almost invariably a sign of leakage in the gastrointestinal canal and a diagnosis of a perforated viscus can rightfully be made from this finding. It should be emphasized, however, that failure of this sign never precludes a diagnosis of ruptured ulcer.

SUMMARY

1. A discussion of confusing symptomology in acute abdominal and acute coronary pathological states has been made.

2. Possible pathways for transfer of these symptoms have been outlined.

3. A series of ninety-two unselected cases has been presented of which coronary occlusion comprised all but one case.

4. The overall incidence of abdominal symptoms in the series was 21.8 per cent and 11.9 per cent of the series had abdominal symptoms as the only symptom complex.

5. The differential aids in the diagnosis of the acute coronary and acute abdominal states were discussed.

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USE OF CHEMOTHERAPY AS POSSIBLE MEANS OF REDUCING MORTALITY RATE IN PERFORATED PEPTIC ULCER*

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THE mortality of 15 to 20 per cent attending the acute perforation of a peptic ulcer is so high and has been so consistent over a period of years that any means of reducing it should be welcome. Both in the records of the past twenty-five years which are accessible to us at Detroit Receiving Hospital, and those reviewed in the literature, the tendency towards a high death rate is unmistakable. Shawan[1] in 1937, reviewed the cases of perforated ulcer which had been treated at Detroit Receiving Hospital, from January, 1920, to January, 1937 and found that the operative mortality was 25.8 per cent. The authors carrying this study up to January 1, 1945, learned that the average operative mortality for the last eight years was 17 per cent. These results are in agreement with those reported from other institutions. In 1934, Eliason and Ebeling[2] collected 5,061 cases which had been recorded in the literature since 1921 and found that the average operative mortality was 23.9 per cent. Since this series apparently included only those patients who were subjected to operation and not those who for a variety of reasons did not come to operation, the actual death rate for perforated ulcers during this period was undoubtedly higher. DeBakey[3] published an extensive review of the literature in 1940. He found that the total general mortality for a collected series of 16,752 cases reported in the previous decade was 25.2 per cent, while the operative mortality for a similar collected series of 15,340 cases was 23.4 per cent. He observed further that the mortality had not decreased appreciably during the ten-year period from 1930 to 1939. The mortality of a collected series of 2,140 cases which were reported in 1930 was 26.1 per cent and that for 2,476 cases reported in 1939 was 23.7 per cent. While in general these figures can be accepted as indicative of the approximate mortality for the year in which they were reported, they are subject to some error as the year in which a series of cases is reported is usually not the year in which the cases were treated. Since most published series encompass a period of ten to twenty years, a more accurate estimate of the current mortality can be obtained if the figures are arranged to include only those cases which have been treated recently. In Table 1 are listed the cases which have been treated in the last fifteen years and have been reported in the English literature since 1939. The gross mortality for this group of 6,240 cases, which includes both operated and non-operated cases, was 19 per cent, while the operative mortality for 2,231 similar cases was 17.4 per cent.

The mortality trend can be determined more satisfactorily if the figures from one institution or from one geographical area are followed over a period of years. Such information is available for the Massachusetts General Hospital from 1896 to 1940 in the papers of Richardson[26] and Ulfelder and Allen [19] (Table 11), and for an area in the West of Scotland in the paper

* From the Department of Surgery, Wayne University College of Medicine and the Division of Surgery, City of Detroit Receiving Hospital. Paper presented before the Society of University Surgeons' Annual Meeting February 7, 8 and 9, 1946.

of Illingsworth Scott and Jamieson.[24] (Table III).

These figures fail to show any substantial decrease in the mortality of this disease during recent years. The experience at the Detroit Receiving Hospital which is given in Table IV is quite similar although there is a decrease in the mortality for the period of January, 1937 to 1945, compared to the period from January, 1920 to January, 1937. This may be explained in part by the fact that Shawan did not include in the first series any cases in which at operation the perforation was found to have sealed itself spontaneously, whereas all cases of acute perforation are included in the later series.

There are in the literature a few reports, such as those of McClure,[11] Graham[27,31] and Berson[7] which show a marked fall in mortality rate during recent years. This, however, is the exception rather than the rule, and it must be admitted that the current operative mortality is in most instances between 15 and 20 per cent, and that the over-all death rate is about 20 per cent. It is true that these results can be improved by early operation, but this is not the entire solution, because first, there will probably always be patients who will not consult a physician promptly; and second, the current mortality is still 9.6 per cent (Table V) for all patients operated within eight hours of perforation. This can be compared with the figures of Eliason and Ebeling[2] who in 1934, found in a collected series of 319 cases that the mortality for those operated within six hours of perforation was 7.5 per cent, while for those operated between six and twelve hours it was 23.9 per cent.

If any significant progress is to be made toward lowering the death rate, it can be accomplished only by combatting bacterial

TABLE I

GROSS AND OPERATIVE MORTALITY FOR CASES OF PERFORATED PEPTIC ULCER TREATED SINCE 1929 AND REPORTED IN THE ENGLISH LITERATURE SINCE 1939

Author	Period	Total Cases	Total Deaths	Gross Mortality, Per Cent	No. Patients Operated	No. Operative Deaths	Operative Mortality, Per Cent
Ross[4]	1939–40	....	....	....	175	28	16.0
Henry[5]	1938–42	....	....	....	179	24	13.4
Cohn[6]	1935–40	....	....	....	300	45	15.0
Berson[7]	1930–40	75	10	13.3			
Timoney[8]	1935–43	....	....	....	246	48	19.5
Martz-Foote[9]	1931–37	....	....	....	50	13	26.0
Sangster[10]	1935–39	....	....	....	100	24	24.0
McClure[11]	1930–39	....	....	....	91	7	7.7
Fobes[12]	1940–41	....	....	....	8	1	14.2
Griswold, Antoncic[13]	1931–40	111	24	23.4	102	20	19.6
McCabe, Mersheimer[14]	1930–41	89	24	26.9	87	22	25.2
Eliason, Stevens[15]	1935–44	....	....	....	17	2	11.7
Straus[16]	1939–43	....	....	....	12	3	25.0
Donald, Barkett[17]	1936–40	124	31	25.0	116	23	19.8
O'Donoghue, Jacobs[18]	1930–39	....	....	....	200	49	24.5
Ulfelder, Allen[19]	1931–40	165	44	26.6			
Raw[20]	1939–44	....	....	....	312	45	14.4
Jackson, Metheny[21]	1941–43	30	8	27.0	24	2	8.0
Barber, Madden[22]	1937–42	....	....	....	86	11	12.8
Nisbet[23]	1932–40	....	....	....	33	10	30.3
Illingsworth, Scott, Jamieson[24]	1930–43	5550	1044	18.1			
Black, Blackford[25]	1935–45	96	14	14.6	93	11	11.8
Total	.....	6240	1199	19.0	2231	388	17.4

infection which is the chief cause of death. A review of sixty-five patients who died following operation for perforated peptic ulcer at the Detroit Receiving Hospital between January 1, 1937, and January 1, 1945, revealed that of the sixty-five deaths, forty-one or 65 per cent, can be attributed directly to infection, either intraperitoneal or pulmonary (Tables VI and VII.) Of the patients whose deaths were the result of infection, eighteen had peritonitis or intraperitoneal abscess, six had pulmonary infection and seventeen had a combination of both intraperitoneal and pulmonary infection. There were, in addition to the forty-one patients cited above, 10 or 15 per cent in whom infection appeared to be an important contributory cause of death. Thus, there were only fourteen deaths (21 per cent) which occurred without evidence of bacterial infection.

The figures in Table VI and VII agree quite well with those reported by other authors. Table VIII shows the figures for several series of collected cases and Table IX gives the causes of death in a collected series of patients reported in the English literature since 1939, who had been operated on during the last fifteen years and for whom the cause of death was accurately recorded.

It is fairly clear from the evidence cited above, that infection, primarily intraperitoneal, but also pulmonary, is the greatest factor which must be dealt with if the death rate from perforated peptic

TABLE II
THE GROSS MORTALITY FOR PERFORATED PEPTIC ULCER AT THE MASSACHUSETTS GENERAL HOSPITAL FROM 1896 TO 1940, AS PUBLISHED BY RICHARDSON[26] AND ULFELDER AND ALLEN[19]

Period	Total Cases	Total Deaths	Mortality, Per Cent
1896–1900	6	5	83.0
1901–1905	12	7	58.0
1906–1910	33	11	33.0
1911–1915	31	9	29.0
1916–1920	36	11	30.6
1921–1925	43	11	25.6
1926–1930	90	24	26.7
1931–1935	74	20	26.5
1936–1940	91	24	26.4

TABLE III
THE GROSS MORTALITY OF PERFORATED PEPTIC ULCER IN THE WEST OF SCOTLAND FROM 1924–1943, AS PUBLISHED BY ILLINGSWORTH, SCOTT AND JAMIESON[24]

Year	No. Cases	Recovered	Died	Mortality, Per Cent
1924	191	142	49	25.7
1925	205	160	45	22.0
1926	274	203	71	25.9
1927	283	222	61	21.6
1928	318	258	60	18.9
1929	335	269	66	19.7
1930	311	240	71	22.8
1931	328	265	63	19.3
1932	336	284	52	15.5
1933	317	247	70	22.1
1934	395	312	83	21.0
1935	378	312	66	17.5
1936	373	302	71	19.0
1937	374	293	81	21.7
1938	431	338	93	21.6
1939	432	357	75	17.4
1940	518	425	93	18.0
1941	615	502	113	18.4
1942	366	306	60	16.4
1943	376	323	53	14.1
Totals	5550	4506	1044	18.8

TABLE IV
THE GROSS AND OPERATIVE MORTALITY OF PERFORATED PEPTIC ULCER AT THE DETROIT RECEIVING HOSPITAL FROM JANUARY, 1920, TO JANUARY, 1945

Period	Total Cases	Total Deaths	Mortality, Per Cent	No. Cases Operated	No. Operative Deaths	Operative Mortality, Per Cent
1920–37	Unknown	Unknown	Unknown	356	92	25.8
1937–38	36	12	33.3	33	9	27.0
1938–39	55	15	27.3	49	12	24.5
1939–40	55	15	27.3	46	7	13.0
1940–41	51	10	19.6	49	8	16.3
1941–42	53	8	15.1	52	7	14.0
1942–43	62	8	12.9	59	5	8.7
1943–44	46	10	21.7	45	9	19.0
1944–45	49	8	16.3	49	8	16.3
Totals	407	86	21.1	382	65	17.01

ulcer is to be lowered. Before discussing the possibility of accomplishing this, it is important to dispel the often quoted statement that the peritoneal exudate is sterile during the early hours subsequent to perforation of a peptic ulcer. A number of authors, among whom are Ross,[4] Urrutia,[29] Ulrich,[30] Brenner,[32] Gibson,[33] Loehr[34] and Deaver and Pfieffer[35] maintain that the peritoneal exudate is sterile for from six to twelve hours. On the contrary, Judine[36] and Bruett[37] found according to DeBakey[3] a high incidence of positive cultures in their cases. Other reports in the literature indicate that bacteria may be recovered from the peritoneal exudate with considerable frequency. In a collected series of 716 cases, bacteria were recovered from 279 or 38.9 per cent. (Table x.) Only three of the authors[5,40,49] whose results are listed in Table x describe the method they employed in making the culture. If as is probably the case, these cultures were obtained by collecting a swab of peritoneal exudate upon opening the peritoneum and only aerobic incubation was employed, it can be safely assumed that the incidence of bacteria in the peritoneal exudate was definitely higher than that given in most of the reports. Henry[5] learned that if swabs were employed to collect samples of peritoneal fluid, bacteria were recovered in only 65 per cent of the cases but when 3 cc. of exudate was used for the culture, the incidence of positive samples was increased to 81 per cent. Dudgeon and Sargent[38] were able to recover bacteria from only four of seven peritoneal fluids, but material obtained from the edge of the ulcer was positive in all seven instances. Since bacteria are probably not uniformly distributed in the material which escapes from the perforation, it is proper to assume that they will not be uniformly distributed in the peritoneal cavity unless there is a considerable amount of fluid present. Conceivably, a piece of contaminated food might lodge under the diaphragm and yet the free peritoneal cavity contain exudate that is relatively sterile. The results seem to indicate that the incidence of positive cultures would increase in direct proportion to the care employed in collecting and incubating the material. The frequency of wound infection and wound disruption lends support to the contention that the peritoneal fluid contains bacteria. DeBakey[3] found that 196 or 25.4 per cent of 772 collected cases had wound infection or wound disruption. The incidence of wound infection in 635 patients who have been operated upon since 1929 and published

TABLE V

THE OPERATIVE MORTALITY FOR CASES OF PERFORATED PEPTIC ULCER TREATED WITHIN THE LAST FIFTEEN YEARS WHICH WERE OPERATED WITHIN EIGHT HOURS AFTER PERFORATION, AND WHICH WERE REPORTED IN THE ENGLISH LITERATURE SINCE 1939

Author	Period	Interval between Perforation and Operation in Hours	No. of Cases	No. of Deaths	Mortality, Per Cent
Martz, Foote[9]	1931–37	6	29	5	17.0
Griswold, Antoncic[13]	1931–40	6	44	2	4.0
O'Donoghue, Jacobs[18]	1930–39	6	27	3	11.0
Raw[20]	1939–44	6	139	9	6.5
Jackson, Metheny[21]	1941–43	8	15	0	
Barber, Madden[22]	1937–42	6	35	0	
Nisbet[23]	1932–40	8	14	2	14.0
Black, Blackford[25]	1935–45	6	46	5	11.0
Illingsworth, Scott, Jamieson[24]	1938–43	8	651	71	10.9
Totals	.....	..	954	92	9.6

TABLE VI

CAUSE OF DEATH IN SIXTY-FIVE OPERATIVE CASES OF PERFORATED PEPTIC ULCER, SEEN AT DETROIT RECEIVING HOSPITAL

Hospital Number	Culture of Peritoneal Fluid at Operation	Cause of Death	Interval between Perforation and Operation	Interval between Operation and Death
S-719	.....	Postoperative lobar pneumonia	4 hr.	4 days
S-6384	.....	Unknown. Had received mercury for lues	16 hr.	12 hr.
S-8524*	.....	Postoperative pneumonia evisceration. Subdiaphragmatic abscess. Gastroplural fistula. Lung abscess. Localized peritonitis	14 hr.	2½ mo.
S-10100*	.....	Generalized peritonitis. Postoperative atelectasis. Pulmonary congestion	10 hr.	32 hr.
S-10634	.....	Eviscerated 9th day. Died of pneumonia 11th day	5 hr.	11th day
S-12628*	Streptococci. Staphylococci. B. coli	Gangrenous duodenum. Subdiaphragmatic abscesses. Tuberculous peritonitis	7 days	12th day
S-14100*	.....	Generalized peritonitis	48 hr.	2nd day
S-20438	.....	Pneumonia	3 hr.	2nd day
S-17176*	.....	Subhepatic abscess. Duodenal fistula	10 days	21st day
T-162*	.....	Coronary arteriosclerosis. Cardiac hypertrophy	4½ hr.	10th day
T-1901*	.....	Generalized peritonitis	23 hr.	5th day
T-2272*	.....	Evisceration 8th day. Pelvic abscess. Cerebellar malacia. Cardiac failure	5 hr.	19th day
T-2502*	.....	Peritonitis	5½ hr.	3rd day
T-2731*	Non-hemolytic streptococci	Peritonitis	23 hr.	11th day
T-3395*	.....	Peritonitis and pelvic abscess	12½ hr.	7th day
T-4350	.....	Peritonitis	3½ hr.	7th day
T-5089*	.....	Peritonitis. Acute cardiac failure	9½ hr.	24 hr.
T-8649	.....	Cause unknown	24 hr.	6th day
T-10027*	.....	Lobar pneumonia	11½ hr.	24th day
T-10726*	.....	Peritonitis. Early lobar pneumonia	4½ hr.	5th day
T-17736	.....	Malnutrition and anemia. Jejunostomy done after pyloric obstruction	8 hr.	2 mo.
V-1146*	Streptococcus viridans	Peritonitis	8 hr.	45 hr.
V-9732*	Staphylococcus albus	Peritonitis. Pneumonia	9¾ hr.	2½ days
V-13225*	B. coli, B. cloacae, B. proteus, streptococcus overgrown by Proteus	Pneumonia. Peritonitis	8½ hr.	6th day
V-14255*	B. coli. Staphylococcus albus	Subhepatic abscess. Pneumonia	6 hr.	6th day
V-18818*	Pneumococci Type 29. B. coli. Staphylococcus albus. Non-hemolytic Streptococci	Peritonitis. Lobar pneumonia	12 hr.	13th day
V-2748*	Streptococcus viridans. B. lactis aerogenes	Peritonitis. Bronchopneumonia	7½ hr.	9 days
V-12415*	Aerobic and anaerobic streptococci. B. Proteus	Subdiaphragmatic abscess extension and ulcer of the chest wall	5½ hr.	5 mo.
X-155*	B. alkaligenes, B. coli. Staphylococcus albus†	Subdiaphragmatic abscess. Pneumonia	21 hr.	12th day
X-2859	Non-hemolytic streptococci. B. coli. B. cloacae	Peritonitis	27 hr.	30 hr.

TABLE VI (*Continued*)

Hospital Number	Culture of Peritoneal Fluid at Operation	Cause of Death	Interval between Perforation and Operation	Interval between Operation and Death
X-9232*	Streptococcus viridans	Subdiaphragmatic abscess. Empyema	4¾ hr.	7th day
X-11381*	Non-hemolytic streptococci. B. coli	Pneumonia. Abdominal abscess. Ca of lung, prostate and pituitary	12 hr.	3rd day
X-11698*	Autopsy cultures. Non-hemolytic streptococci. B. coli. B. lactis aerogenes	Lobular pneumonia. Peritonitis	24 hr.	5th day
X-17616	Non-hemolytic streptococci	Peritonitis	24 hr.	17 hr.
X-18642	Streptococcus viridans	Pneumonia Type 24. Peritonitis	11¾ hr.	15th day
X-13983*	Streptococcus viridans. Spore bearers	Left subdiaphragmatic abscess. Multiple lung abscesses	14 hr.	1½ mo.
41-466*	No growth	Lobar pneumonia, pneumococcus Type 2	3¾ hr.	7th day
41-3100*	Non-hemolytic streptococcus	Pneumonia. Peritonitis. Streptococcus septicemia	7 hr.	8th day
41-12562	Streptococcus viridans. B. coli	Cause unknown. Believe to have multiple sclerosis	8 hr.	15th day
41-13512	No growth	Peritonitis	9½ hr.	5th day
41-14414	B. coli. Non-hemolytic streptococci	Pneumonia	4¼ hr.	2nd day
41-2742	Streptococcus viridans. Hemolytic streptococci	Intestinal obstruction. Empyema	3¾ hr.	2 mo.
41-17886	Non-hemolytic streptococci	Peritonitis	3 days	11th day
42-650	.....	Shock (sub-total gastric resection)	7½ hr.	11 hr.
42-4448*	B. coli. Yeasts	R.L.L. Pneumonia. Peritonitis	12 hr.	2nd day
42-8508	No growth	Unknown	5½ hr.	9th day
42-1739*	Streptococcus viridans	Pneumonia. Massive pulmonary embolus	12 hr.	6th day
42-9654*	No growth	Peritonitis	30 hr.	2nd day
43-2570	.....	Cause unknown. Chronic alcoholic. Course progressively downhill	17 hr.	40th day
43-4387	.....	Peritonitis	14 hr.	19th day
43-4730*	.....	Pulmonary embolus	5 hr.	10th day
43-6100*	Non-hemolytic streptococci. Spore bearers	Peritonitis	9 hr.	8th day
43-8125	Staphylococcus albus. Streptococcus viridans	Pneumonia. Peritonitis	18½ hr.	4th day
43-6517*	B. coli. Spore bearers	Peritonitis	44 hr.	3rd day
43-7496	Streptococcus viridans. Staphylococcus albus	Peritonitis	10 hr.	4th day
43-7863	Staphylococcus albus. Hemolytic streptococcus	Peritonitis. Pleural effusion	48 hr.	31st day
43-10571	.....	Shock	17 hr.	6 hr.
44-158	B. coli. Spore bearers	Cause unknown	24 hr.	1 day
44-1372	Pneumococci. Type 13	Peritonitis	3 days	22nd day
44-5738*	Staphylococcus albus. Pneumococcus Type 13	Peritonitis. Pulmonary TBC	7 hr.	2nd day
44-7612	B. coli. Streptococcus viridans	Malnutrition. Patient became psychotic	8 hr.	15th day
44-11825	Staphylococcus albus. Non-hemolytic streptococcus	Gastric fistula	14 hr.	17th day
44-15687*	B. coli. Non-hemolytic streptococcus	Peritonitis. Volvulus intestinal obstruction	36 hr.	25th day
44-15936*	No growth	Lobular pneumonia	15 hr.	7th day
44-16099*	Pneumococcus	Peritonitis. Lobular pneumonia	18 hr.	3rd day

* Autopsy.
† Autopsy culture.

in the English literature since DeBakey's review is 22.5 per cent. (Table xi.)

It therefore seems logical to assume that if infection could be controlled the mortality attending the perforation of a peptic ulcer would be lowered. A number of authors, among whom are Flemming,[28] Eliason and Stevens,[15] O'Donaghue and Jacobs,[18] Eliason and Ebeling,[2] McNealy and Howser,[51] Paletta and Hill,[52] Timoney,[8] Griswold and Antoncic,[13] Ulfelder and Allen,[19] have recognized this fact and several have suggested the use of sulfonomides.[3,15,19,52] Conclusive evidence in support of the efficacy of the sulfonamides as a means of controlling infection has not yet been published, but it seems safe to predict that the death rate will not be reduced appreciably by such therapy since the sulfonamides in therapeutic concentrations are effective against only certain bacteria. Peritonitis in these cases may result from any organism capable of inhabiting the mouth, nose and pharynx or which may be present in food. Usually a variety of bacteria are present. It is likely, therefore, that the two antibiotic agents, penicillin and streptomycin, would be more effective than the sulfonamides because their combined range of antibacterial activity includes most of the organisms which cause infection in such patients. It is the author's contention that early and intensive treatment with these antibiotics would lower the mortality significantly. Doses of 75,000 to 100,000 units of penicillin every two hours and 0.5 of a Gm. of streptomycin intramuscularly every six hours are not too large. Therapy should be started as soon as the diagnosis is established and continued until the temperature has been normal for several days or until it is evident that treatment is ineffective. In these cases one is usually dealing with an unknown mixture of bacteria, some of which may be quite resistant to penicillin or streptomycin, and it is essential to employ a dose which will provide a concentration high enough to inhibit fairly resistant organisms. The tendency to use small doses of penicillin stems from the fact that when penicillin was first available it was so scarce that small doses had to be employed. A number of therapeutic failures may have been due to an inadequate dose. It has recently been demonstrated in the treatment of subacute bacterial endocarditis that cases similar to those which formerly failed to respond to penicillin therapy can be cured if large enough doses are used.[53] Crile and Fulton[54] have presented evidence which seems to show that large doses of penicillin (100,000 units every two hours) are more effective in the treatment of peritonitis arising from inflammation of the appendix than the conventional smaller doses.

If penicillin and streptomycin are to be given a fair chance, the doses should be large and treatment should be started as soon as the diagnosis is made rather than at the close of the operation. All forms of chemotherapy are more effective during

Table vii
(summary of table vi)

	No.	Per Cent
Number of deaths	65	
Patients dying of peritonitis	18	27.6
Patients dying of pulmonary complications	6	9.0
Patients dying of both peritonitis and pulmonary complications	17	26.0
Patients in whom infection appeared to be an important contributory cause of death	10	15.0
Patients dying of other causes than infection	14	21.0

Table viii
causes of death in several collected series of perforated peptic ulcer

Author	Year	No. of Deaths	Per Cent Due to Intraperitoneal Infec.	Per Cent Due to Pulmonary Complications	Total Per Cent Deaths Due to Infections
Flemming[28]	1931	253	69.9	13.0	82.9
Eliason and Ebeling[2]	1934	672	63.9	15.3	79.2
DeBakey[3]	1940	952	57.2	20.8	78.0

the invasive phase of the infection than they are after the bacteria have become well established. Presumably it will be sufficient to administer the antibiotics systemically, since it has been shown[55] that streptomycin given intramuscularly or intravenously to such patients rapidly appears in the peritoneal exudate. While it has not been demonstrated that penicillin reacts in a like manner, it seems likely that it, too, will appear in the peritoneal fluid promptly after intramuscular or intravenous injection.

We do not wish to leave the impression that chemotherapy will make it possible to neglect other essential measures in the pre- and postoperative care of these patients. Both McClure[11] and Graham[27,31] who have obtained remarkably low death rates (7.7 per cent for ninety-one cases and 6.3 per cent for 111 cases, respectively) have emphasized the need for adequate preoperative preparation of the patient. They point out that the restoration of a normal blood and interstitial fluid volume by the administration of whole blood, plasma and electrolyte solutions is of great importance.

Graham[31] in particular, on the basis of this experience, minimizes the bacterial infection as a cause of death and suggests that the mortality could be lowered by more carefuly attention to the preoperative preparation of these patients. The necessity of restoring the blood and interstitial fluid volume to near normal is emphasized by the number of reports in the literature describing deaths from spinal anesthesia or from shock shortly after the operation. Although the importance of proper pre- and postoperative care should be stressed, the fact still remains that there is considerably evidence to show that bacterial infection, either intraperitoneal or pulmonary, is also a significant cause of death. It seems, therefore, that the lowest mortal-

TABLE IX

CAUSE OF DEATH IN PATIENTS WHO WERE OPERATED ON FOR PERFORATION OF A PEPTIC ULCER IN THE LAST FIFTEEN YEARS, AS RECORDED IN THE ENGLISH LITERATURE SINCE 1939.

Author	Period	No. of Deaths	Peritonitis		Pulmonary Infection		Peritonitis and Pulmonary Inf.		Other* Causes		Total Per Cent of Deaths Due to Infection
			Autopsy	No Autopsy	Aut.	No Aut.	Aut.	No Aut.	Aut.	No Aut.	
Martz, Foote[9]	1931–37	13	5	1	1	1	1	..	..	4	69.2
Timoney[8]	1935–43	14	3	2	0	6	0	0	..	3	78.5
McClure[11]	1930–39	7	0	3	0	1	0	0	..	3	57.1
Fobes[12]	1940–41	1	..	..	..	..	..	..	..	1	0.0
Griswold, Antoncic[13]	1931–40	20	0	10	0	0	0	6	0	4	80.0
Donald, Barkett[17]	1936–40	7	0	6	0	0	0	0	1	0	57.1
Jackson, Metheny[21]	1941–43	2	0	0	0	1	0	0	0	1	50.0
Nisbet[23]	1932–40	10	7	0	1	0	0	0	2	0	80.0
Black, Blackford[25]	1935–45	11	0	6	0	3	0	0	0	2	81.8
		85	15	28	2	12	1	6	3	18	

* Death in some of the cases as listed in this column may have been due to infection either not recognized or other than pulmonary or intraperitoneal. For example, the cause of death for one of the cases in the group of Griswold and Antoncic is given as hemolytic streptococcus septicemia. Other authors have listed patients as dying of shock, which may have been due to fulminating peritonitis, or of duodenal fistula in the cause of which infection may have played a role.

ity rate would be obtained by combining chemotherapy with adequate preoperative preparation and careful postoperative care.

SUMMARY

1. The operative mortality attending acute perforation of peptic ulcer is in most instances between 15 and 20 per cent.

2. Approximately 80 per cent of the deaths are due to bacterial infection either intraperitoneal or pulmonary.

3. Most of the bacteria involved in these infections are susceptible to penicillin or streptomycin.

4. It is believed that early and intensive treatment with penicillin and streptomycin of all patients with perforated peptic ulcer would reduce the mortality rate of this disease.

5. Chemotherapy should be considered an aid in the treatment of such cases and should not be substituted for careful surgery, or adequate pre- and postoperative care.

TABLE X

THE INCIDENCE OF BACTERIA IN THE PERITONEAL FLUID OF PATIENTS WITH PERFORATED PEPTIC ULCER

Author	Year	No. of Cases	No. of Positive Cultures	Per Cent of Positive Cultures
Dudgeon, Sargent[38]	1905	7	4	57.1
Deaver[39]	1913	20	6	30.0
Dudgeon, Maybury[40]	1915	23	10	43.5
Walker[41]	1915	29	14	48.3
Alexander[42]	1917	13	3	23.1
Richardson[26]	1917	35	7	20.0
Deaver, Pfieffer[35]	1921	34	11	32.4
Gibson[43]	1928	43	15	34.9
Mattingly[44]	1931	46	9	19.6
Brenner[32]	1935	21	0	0.0
Trout[45]	1935	21	0	0.0
Chang, Chi Cheng[46]	1937	31	13	41.9
Graham[28]	1937	30	10	33.3
McCreery[47]	1938	42	22	52.4
Fallis[48]	1938	36	12	33.3
Davison, Aries, Pelot[49]	1939	34	18	52.9
Martz, Foote[9]	1940	23	12	52.2
Griswold, Antoncic[13]	1941	65	31	47.7
Berson[7]	1942	31	10	32.3
Henry[5]	1942	48	39	81.3
Estes, Bennet[50]	1944	25	8	32.0
Graham, Tovee[31]	1945	59	25	42.4
Totals		716	279	38.9

TABLE XI

THE INCIDENCE OF WOUND INFECTIONS IN PATIENTS WITH PERFORATED PEPTIC ULCER

Author	Year	No. of Cases	No. of Infections	Per Cent of Cases Infected
McClure[11]	1930–39	91	7	7.8
McCabe, Mersheimer[14]	1930–41	87	27	31.0
Martz, Foote[9]	1931–37	50	6	12.0
Griswold, Antoncic[13]	1931–40	84	28	33.3
Timoney[8]	1935–43	246	63	25.6
Black, Blackford[25]	1935–45	93	10	10.8
Fobes[12]	1940–41	8	2	25.0
Totals		659	143	21.7

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ANOMALOUS TALOCALCANEAL ARTICULATION

CAUSE FOR LIMITED SUBTALAR MOVEMENTS

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IN two recent patients with sprains of the ligaments of the ankle and in a third with a fresh simple fracture of the fifth metatarsal bone, we observed the presence of limitation of passive subtalar rotatory movements. On further study of these three patients we noted the presence of an unusual anomaly of the talus and calcaneus. This abnormality which consisted of a bilateral symmetrical projection of bone on the medial surface of the talus and calcaneus, respectively, formed an accessory talocalcaneal articulation.[1] Since limitation of subtalar movements was present bilaterally, the conclusion was that the anomaly and not the recent trauma was the basis for the limited subtalar movement.

This paper is presented first, to emphasize the point that anomalous bony protuberances in the talocalcaneal region may result in limitation of subtalar movements and secondly, that these bony masses can be detected by radiographic examinations made in special oblique views of the feet.

HISTORY AND PHYSICAL EXAMINATION

A review of the three patients in question showed that each suffered from a recent trauma to the ankle or foot. The diagnosis in the first was a simple fracture of the base of the fifth metatarsal bone, and in the other two, severe sprain of the ligaments of the ankle joint. Examination revealed, in addition to the local swelling and pain caused by the trauma, an enlargement on the medial aspect of the foot which was most prominent just below and slightly posterior to the inner malleolus. A smaller but similar type of prominence was encountered on the opposite foot of each of the three patients. In one of the three patients the protuberance on one foot was the size of a large cherry and was markedly tender to touch. On further questioning, this patient stated that he frequently wore low quarter shoes because of these painful bony masses. The striking finding on examination of these three patients was the limitation from 5 to 15 degrees in the range of passive subtalar movements as compared to normal.

Radiographs taken in the conventional anteroposterior and lateral views did not clearly disclose the abnormality in the tarsal bones. When, however, examination of the talus was made in an oblique view, i.e., the leg in an externally rotated attitude from 10 to 25 degrees, one observed apposing beaks of bone projecting from the posteromedial aspects of the talus and calcaneus, respectively. In addition, a joint space was seen in anomalous talar and calcaneal protuberances. In one of the three patients who presented the largest abnormal bony projection in the group, the subchondral regions of one of the accessory talocalcaneal articulations were irregular in outline. (Fig. 1.)

Ordinarily no special treatment except the wearing of low quarter shoes is advised; however, the one patient in whom the bony projection was extremely large requested that something be done which would permit him to wear regular "G. I." shoes. Operative intervention was performed to expose the medial surface of the subtalar region of one foot. Twin beaks of bone which projected from the posterior portion of the medial surfaces of the talus and calcaneus, respectively, were clearly visualized as was the anomalous joint space. Each promonotory was only partly resected in order to retain the bony canal for the passage of the flexor hallucis longus tendon. (Fig. 2.) No operation was performed on the opposite foot.

The follow-up examination of this patient for a period of twelve months after the operation revealed that he was able to wear "G. I." shoes and had experienced only occasional local discomfort. Radiographic examination made, at intervals of

three months during this one year follow-up, showed no reformation of bone at the site of resection. There was no apparent increase in the range of subtalar movements after the operative intervention. The subtalar region on the medial aspect of the operated foot was normal in appearance and was not tender to firm local pressure or percussion.

The other two patients who did not require any surgical intervention received permission to wear low quarter shoes and apparently had no further complaints.

The examination of the tissue removed at the time of operation showed that the articular surfaces of the bony projections removed from the talus and calcaneus were dull, pitted and covered with fibrocartilage. The microscopic examination confirmed these findings as well as the existence of fibrosis of the subchondral marrow spaces. This pointed to an existence of a degenerative osteoarthritis of the anomalous talocalcaneal articulation.

COMMENTS

Whenever subtalar movements are restricted, either in association with flat feet or after a fresh trauma to the ankle or foot, it is suggested that oblique views be taken to the subtalar region in order to visualize the medial surfaces of the posterior half of the talus and calcaneus. In medicolegal cases it is important to check for this anomaly especially when restriction of subtalar movements is encountered after local trauma.

As for the basis of this anomaly, it is believed that an accessory island of bone in the region of the sustentaculum tali (os sustentaculi) fused with the calcaneus to form the bony promontory. Similar changes probably had occurred on the medial aspect of the talus. Apparently these anomalous bony projections interfere with the passive rotation of the calcaneus.

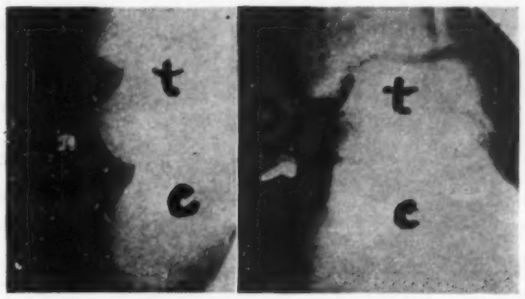

FIG. 1. FIG. 2.

FIG. 1. Radiographic examination made in the oblique view shows symmetrical bony projections from the postero-medial aspects of the talus and calcaneus. Similar but smaller projections were present in the opposite foot; "*t*"-is the talus and "*c*" is the calcaneus.

FIG. 2. Note the resected bony projections of the talocal caneal articulation.

CONCLUSION

In three patients who suffered from recent trauma to the ankle or foot, we observed an anomalous bony projection from the medial surfaces of the talus and calcaneus, respectively. These bony prominences formed an accessory articulation and interfered with the normal range of passive movements of the calcaneus. Thus, the limitation of motion found in these patients was not the result of recent trauma but directly related to the anomalies of the feet. Only by making radiographic examinations in oblique views of the talus can these abnormal bony projections be clearly visualized. When these projections are unusually painful, large and interfere with the wearing of shoes as was noted in one case, resection is necessary; otherwise, the wearing of low quarter shoes is indicated.

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SYMPATHETIC NERVE BLOCK IN HYPERTENSION AND ALLIED CASES

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SINCE 1939 we have been interested in the therapeutic uses of nerve block with alcohol. In the beginning our work was limited to intractable cardiac-asthma cases. However, for the past four years, we have performed alcohol blocks for hypertension and have arrived at some definite conclusions as to the results to be expected and the technic to be used. The advantage in this method over resection by surgery is its simplicity of performance and its less traumatizing effect on the patient.

The ganglion block for hypertension is done in two stages. Upon admission, the patient has a complete workup including an electrocardiograph, chest *x*-ray, Fishberg urine concentration test, urea nitrogen and creatinine determination, an eye ground examination and a series of blood pressure recordings. This series consists of five-minute lying, sitting and standing blood pressures and each of these is followed by another reading after the patient has had his hand immersed in ice water. When the necessary information is obtained the patient is then scheduled for the first stage. A preliminary hypodermic of morphine sulfate gr. $\frac{1}{6}$ and scopolamine hydrobromide gr. $\frac{1}{200}$ is given one hour before the operation. Cyclopropane is the preferred anesthesia.

Equipment needed for the procedure consists of:

Sterile

6 long spinal needles
2 medicine glasses
1 five cc. syringe
4 towels
Cotton balls and wipes
Gloves

Unsterile

China glass pencil
2 Ace bandages
Scultetus binder
Blood pressure machine
Stethoscope

Solutions

Absolute alcohol
Tincture of merthiolate
Novocaine 1%

Before and after the induction of anesthesia, the patient's blood pressure is taken and the cuff is then left on throughout the entire procedure. As soon as the patient is anesthetized, he is placed prone on the table with the arms outstretched and the toes extended just beyond the end of the table so that the legs are straight. The entire back from the neck to the coccyx is exposed. All points for injection are mapped out with the china glass pencil. A line is drawn along the spinous processes to include the eighth to twelfth thoracic and first lumbar vertebrae. Then at each spinous interspace a line is drawn perpendicularly to the vertical line. On the side to be injected at this time, another line is drawn parallel with the spinous process line and 4 cm. away from it. Where this line crosses each horizontal line, the sites for injection are located.

Each spinal needle is then inserted so that it impinges upon the transverse process. It is then withdrawn slightly and with a downward and inward tilt it is passed beneath the transverse process for a distance of approximately 1 cm. All of the six needles are thus placed into the sites of the eighth to twelfth thoracic and first lumbar ganglia. Five cc. of 1 per cent

novocaine is then injected into the first lumbar needle and that needle is withdrawn, leaving five needles *in situ*. Thereafter, 4 cc. of absolute alcohol is injected into each of the remaining needles. As soon as the absolute alcohol is injected the needle is withdrawn. Aspiration before injecting any solution assures that the needle is not through the pleura or in any vessel. If blood or air is obtained replace that needle before injecting the solution.

The injection of the novocaine into the lumbar site prevents the alcohol from running down the plane in front of the vertebrae into a lower site and causing a paralysis. It also prevents a sciatic neuritis previously encountered before doing this. The novocaine acts as a pool in which the alcohol diffuses and becomes harmless.

The blood pressure is taken immediately upon the completion of the procedure and every few minutes thereafter until the drop has become stationary. Oxygen should be started as soon as the procedure is completed to assist the patient to react more quickly from the anesthetic and to prevent hypotension shock. The patient is kept prone until completely reacted and only then is turning permitted. Lying prone produces abdominal pressure which prevents any severe drop in the blood pressure. In order to maintain abdominal

Case	G. M. 10/3/43 61 yr. Female	R. P. 11/10/43 28 yr. Male	J. C. 4/44/44 66 yr. Male	W. P. 5/31/44 29 yr. Male
Classification*	II	III	II plus Asthma	
Blood pressure: pre-op post-op	 270/160 160/100	 210/140 170/100	 195/135 140/80	 190/10 140/70
Urine	negative albumin casts concentration—fair	albumin—trace sugar—trace concentration—fair	albumin—trace	negative
Eye grounds	moderate arteriosclerosis	silver-wire thin arteries left palpebral fissure enlarged	arteriosclerotic changes	negative
Heart	enlarged	left ventricular hypertrophy systolic murmur at apex not transmitted	marked enlargement verge of congestive failure	aortic insufficiency following Rheumatic Fever
Symptoms	persistent vertigo	blurred vision headaches head pressure and fullness chest tightness	Asthma—25 yr. bed-ridden intermittently for four years headaches vertigo chest tightness expectoration—cupfull daily	hammer pulse head pounding chest tightness vertigo
Remarks	now symptom-free no medications	thoracic 8–9 were not done in this early case advised to return for this block, but declines because he is symptom-free	thoracic 1–4 bilateral no asthma since expectoration—negligible no cardiac stimulants symptom-free	left side only done immediately symptom-free and has remained so

* As classified by Smithwick.

pressure after the patient is turned, an abdominal binder may be applied.

As soon as the patient has reacted, he is returned to his bed and is encouraged to drink some hot fluids such as tea, coffee or broth. Careful check on the blood pressure is maintained and if at any time the systolic pressure drops to 100 or below, or if dyspnea occurs, oxygen is administered by mask and ace bandages are applied to the legs and the abdominal binder is tightened.

The second stage or the other side is done from five to seven days after the first stage. In the interval the patient is on a regular diet and is allowed out of bed as soon as able. Usually this is on the second or third day. The results have been more satisfactory when the left side is blocked first. The operative method and post-operative care is exactly the same for the second stage.

We have found another advantage in this type of procedure in that it widens the scope of its feasibility. Treatment of advanced cases has been attempted and in spite of their classifications which would have precluded surgery, several of these early cases are still alive after three years and are comparatively symptom-free.

The summary shown in the table on page 67 includes cases which have been chosen for their wide diversification of symptoms and length of time following surgery.

The following is an example of an advanced case done more recently:

A female, age fifty years, presented the following symptoms: persistent headaches, blurred vision, vertigo, inability to walk without staggering, nausea, primarily bed-ridden for four months.

Retinal changes showed marked AV compression; the vessels had a full copper wire appearance in right disc and left retina had a large hemorrhage below disc at about five o'clock. Blood pressure was fixed at 230/130 to 270/150. The heart was enlarged with congestive heart failure at times. An electrocardiograph showed left ventricular hypertrophy and myocardial damage. Urinalysis showed concentration fair with a trace of albumin.

A bilateral thoracic eighth to twelfth was done in stages and the patient was discharged with a blood pressure of 190/110 and all symptoms gone except for blurred vision which was due to the hemorrhage.

She was seen after two months, having some cardiac distress but no head pounding and was otherwise still symptom-free. The eye grounds were markedly improved. The left thoracic third was blocked as an out-patient and after two weeks the heart was much improved and stronger; blood pressure now was 170/100.

Contrary to what was anticipated in the beginning that this procedure might be only a temporary relief, it has proven to be permanent. The symptoms of headache, headpressure, dizziness and vomiting are quickly corrected and our earliest patients are not only still symptom-free but also maintaining lower blood pressures. We are convinced that this is a much simpler and less drastic method than the sympathetic nerve and ganglion destruction by operative procedure as recognized throughout the world today.

Experimental work is now being done in combining thoracic one, two, three and four in separate stages to improve the heart action along with dropping the blood pressure. It is this approach that may give some relief for the malignant type of hypertension which is yet non-curable.

In conclusion may it be said that we believe the alcohol nerve blocks as described in this article have a definite place in the armamentarium of today in hypertension and asthma.

Case Reports

ANTERIOR THORACIC ESOPHAGUS

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FORTY newborn babies with esophageal atresia and tracheoesophageal fistula have been successfully treated at The Children's Hospital in Boston. Of this group, twenty-three have had successful end-to-end anastomosis of the esophagus.

Because primary anastomosis was deemed inadvisable, the remaining seventeen infants had multiple-stage procedures. The operations consisted of division of the tracheoesophageal fistula, gastrostomy, and marsupialization of the esophagus to the skin of the neck. Until such time as an anterior thoracic esophagus has been made, the children are fed by gastrostomy.

These seventeen patients now range in age from one month to seven years. For eight of them a connection has already been made between the upper esophagus and the intra-abdominal intestinal tract.* The problems encountered in building the artificial esophagus, in each case, are described in the following pages. Procedures are now in progress for two children, and will soon be undertaken for the remaining seven.

DERMO-ESOPHAGOPLASTY

The first successful anterior thoracic esophagus in this group was for a patient who is now seven years old. It consists of a skin tube between the esophagostomy and the gastrostomy. The difficulties encountered in this case, by Dr. W. E. Ladd, are similar to those reported by Oschner and Owens.[1] Fourteen operative procedures, over a period of two years, were required to complete the new esophagus. Healing was slow at the lower end of the skin tube; fistulas developed, which eventually closed spontaneously. Hospitalization was greatly prolonged by these complications.

The anterior thoracic esophagus was completed three years ago. Four months after completion of the skin-tube-gastrostomy junction became necessary, and has subsequently been required at two- to three-month intervals. Furthermore, the patient has occasional discomfort in the skin tube, presumably due to the reflux of irritating gastric juices. That this pain is related to the action of the acid gastric fluid is substantiated by the prompt relief following the ingestion of sodium bicarbonate. Yurasov[4] states that patients with this type of artificial esophagus frequently have a burning sensation in the skin tube. He also reports one case of ulcer of the skin tube and perforation, and remarks that von Hacher had a similar case which terminated fatally.

We are happy to report that, in spite of her past troubles, this alert, attractive little girl leads a normal life, attends school and follows a regular diet. No disfigurement is in evidence when the child is dressed.

In a second case, the lower esophagus was marsupialized to the skin just above the costal margin in order to avoid a dermo-gastric anastomosis. An unsuccessfull attempt was made to connect the esophagostomy in the neck with the lower

* An anterior thoracic esophagus was completed for two other children, but the patients died postoperatively. These cases are also reported in the text.

segment of esophagus by means of a skin tube. Pyloric obstruction developed, probably due to an inadvertent bilateral vagotomy. This caused profuse drainage of gastric secretions through a fistula which developed in the skin tube. A soft rubber

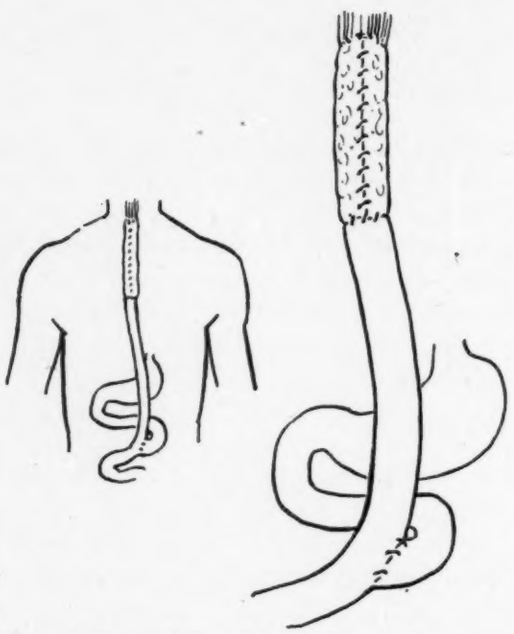

Fig. 1. Schematic drawing of anatomical arrangement for esophagoplasty proposed by Wullstein.

catheter was passed through the pylorus into the duodenum, in the hope of relieving the pyloric obstruction. However, after the catheter had been intermittently in place for seven weeks, a perforation of the duodenum occurred, producing generalized peritonitis, which was the cause of death.

It became clear from these two experiences, as well as from the literature,[1,3,4] that two hazards must be avoided in esophagoplasty: (1) Gastric juices must be prevented from refluxing into the skin tube; and (2) it is not desirable for gastric mucosa to be in continuity with the dermic tube, because the acid secretions of the gastric mucosa probably delay or prevent healing between these structures.

Wullstein[2] postulated a type of esophagoplasty in which the above faults were corrected. He suggested that the jejunum should be divided close to the ligament of Treitz, and the first one or two intestinal vessels to the lower jejunal segment ligated and divided to free the distal segment of the jejunum. This was then to be brought subcutaneously over the thoracic cage, and the gap between this jejunum and the esophagostomy bridged by a skin tube. The anatomical arrangement is outlined in Figure 1.

Continuity of the intestinal tract was next to be re-established by an end-to-side anastomosis of the jejunum. Theoretically, it would seem that having food pass directly into the small bowel would be objectionable, but reports in the literature[1,3,4] have disproved this objection. These reports have since been confirmed by the results in our own four successful cases with jejunodermal esophagoplasty. These patients are normal children, eat three meals a day and have no complaints.

CASE REPORTS

Case 1. (W. W.—267162). As a newborn, this patient had an esophageal atresia and a tracheoesophageal fistula. Dr. W. E. Ladd performed a series of operations, consisting of ligation of the fistula, gastrostomy and marsupialization of the esophagus.

When the boy was one year of age, a beginning was made by Dr. W. E. Ladd on an anterior thoracic esophagus by raising a rope graft from the right axilla and side. One month later its lower end was detached and implanted above the esophagostomy. After an interval of thirty days a skin tube was turned in, which included the esophagostomy and extended almost to the costal margin. The resulting skin defect was covered by the opened rope graft.

Eighteen months later a segment of the jejunum was brought up subcutaneously and anastomosed to the skin tube. The continuity of the jejunum below this was established by a side-to-side anastomosis. No fistula had developed by the tenth postoperative day, and the child began to take fluids by mouth. In a short time a proper diet for his age was being taken.

After a year had elapsed, some solids were refused by the child. Roentgen examination seemed to indicate a narrowing of the dermojejunal junction, and dilatation was carried out.

However, no stricture was encountered, a No. 28 dilator passing into the jejunum with ease. In retrospect, it seems that the roentgen report was misleading, and that the little boy simply refused certain solids because he disliked them. Since that procedure, six months ago, this four-year-old child has continued to do well, eating normally and gaining in weight.

Case II. (D. V.—277277). At four days of age this child was admitted to The Children's Hospital because of atresia of the esophagus and tracheoesophageal fistula. These anomalies were corrected by Dr. W. E. Ladd by ligation and division of the fistula, gastrostomy and marsupialization of the esophagus to the neck.

The formation of an anterior thoracic esophagus was begun by Dr. Ladd and the author when the little boy was twenty-two months old. First, a rope graft was raised in the right axilla and side. Three weeks later the lower end was transferred to the neck just above the esophagostomy. Healing progressed favorably, and at the expiration of three weeks a skin tube was turned in which included the esophagostomy and extended almost to the costal margin. The rope graft was opened and used to cover the turned-in tube. After two months, when the rope graft was well healed, the jejunum was divided close to the ligament of Treitz and freed by the division of two adjacent intestinal arteries. The distal end of the jejunum was brought subcutaneously up to and anastomosed to the skin tube. Last, a side-to-side anastomosis was made to re-establish continuity of the jejunum.

As no fistula developed postoperatively, food was taken by mouth beginning about three weeks after the final operation. Two months later, however, because solids would no longer pass from the skin tube to the jejunum, a gastrostomy was performed and the dermojejunal anastomosis explored. The opening was found to be only 2 mm. in diameter, and the anastomosis was revised so that the stoma measured 2 cm. in diameter. This boy is now (six months later) taking solids and gaining in weight.

Case III. (S. G.—279539). At two days of age this patient was admitted to The Children's Hospital, where a diagnosis of esophageal atresia with tracheoesophageal fistula was made. Dr. W. E. Ladd ligated and divided the fistula, and several days later carried out gastrostomy and marsupialization of the esophagus. The little girl did well, and at 21 months was an obese, robust child.

At this time construction of an anterior thoracic esophagus was begun by Dr. Ladd and the author. First, a rope graft was elevated from the right axilla and side and the raw area covered by a Thiersch graft. One month later the lower end of the tube graft was detached and implanted above the esophagostomy. The implantation was successful, and at the end of thirty days a skin tube was turned in on the anterior chest from the esophagostomy to the level of the seventh rib, left of the midline. The turned-in tube was covered by the rope graft.

Three weeks later a segment of jejunum was brought up subcutaneously and anastomosed to the skin tube. A side-to-side anastomosis was then made between the proximal jejunum and the jejunum which had been brought up subcutaneously. Postoperatively, the child did well, except that a fistula developed at the dermojejunal anastomosis. This was treated expectantly, and closed in six weeks.

Although the child's family had been told to give her fluids by mouth during the period of gastrostomy feedings, they had neglected to do so. Consequently, it took months of patience, first on the part of the nurses, and later by the parents, to teach her to take food by mouth. However, she is now taking most of her food orally. Roentgenograms show no evidence of strictures in the new esophagus.

Case IV. (E. O.—278540). This patient was admitted to The Children's Hospital at two days of age, with a diagnosis of esophageal atresia and tracheoesophageal fistula. Shortly after the admission Dr. W. E. Ladd ligated and divided the fistula. Three days later a gastrostomy was performed. Seven days following the second operation, the esophagus was marsupialized in the neck. The child did well and developed normally.

When the little boy had reached the age of twenty months, the construction of an anterior esophagus was begun by the author with the raising of a rope graft on the right side of the chest. One month later the lower end of the rope graft was freed and implanted above the esophagostomy. A skin tube was turned in four weeks later, extending from the esophagostomy to a point 3 to 4 cm. above the costal margin, and was covered by the rope graft. At the end of another two months a segment

of jejunum was brought up under the skin and anastomosed to the skin tube, and continuity of the jejunum was also established. An uneventful recovery followed. While some redness occurred at the jejunodermal anastomosis, no fistula developed.

This child also had to be taught to eat, as all previous feedings had been by gastrostomy and no fluids had been given orally. However, in a few weeks' time all intake was by mouth and continued to be until six months after operation, when soft solids were refused. Roentgen examination indicated an obstruction at the dermojejunal anastomosis. Dilatation was carried out, and since then (two months) fluids and solids are taken with ease. The gastrostomy tube has been removed.

Case v. (J. McE.—276848). At four days of age this baby was admitted with a diagnosis of esophageal atresia and tracheoesophageal fistula. Ligation of the fistula, followed by gastrostomy, and by marsupialization of the esophagus, were carried out by Dr. W. E. Ladd.

The little boy did well, and when he was twenty-two months old formation of an anterior throacic esophagus was begun by Dr. Ladd and the author. The dermic portion of the new esophagus extended down almost to the costal margin, and required three operative procedures: raising of the rope graft, transfer of the tube graft and turning in of the skin tube. Four months after the beginning of this series of operations the jejunum was divided close to the ligament of Treitz and two intestinal vessels were cut to free the distal segment. This free segment was brought up subcutaneously, its side anastomosed to the end of the skin tube, and then continuity of the jejunum re-established by a side-to-side anastomosis. One week after this the patient developed a fistula at the dermojejunal anastomosis, which closed only to have a new fistula develop in the midportion of the skin tube. Two unsuccessful attempts were made to close the second fistula, which, however, gradually decreased in size and became free of infection.

About one month after the last procedure the child developed a temperature of 105°F., became comatose, and died in forty-eight hours. Spinal fluid was negative. Permission for a necropsy could not be obtained; it was, however, believed that the cause of death was not related to the surgical procedures, as there was no evidence of infection along the anterior thoracic esophagus, and no sign of intra-abdominal disease.

In the four completed cases, jejunodermal esophagoplasty proved to be a distinct improvement over the procedures which utilize a skin tube between the esophagus and the stomach. Each esophagoplasty was completed in a series of four operations. Hospitalization time averaged five months for each child. In four cases, function was adequate. In the fifth case the patient died while a fistula was still present and feedings had not been attempted on a full scale.

The jejunodermal esophagoplasty does, however, present certain difficulties. A minimum of four operations is necessary, making the hospitalization time a long one. A fistula developed in two of the five patients, one fistula closing spontaneously. Two of the children developed strictures at the site of the dermojejunal anastomosis, one requiring excision of the scar, and the other dilatations. Furthermore, it is true that considerable cosmetic disfigurement is inevitable, as is shown in Figure 2.

JEJUNAL ESOPHAGOPLASTY

In an attempt to avoid these disadvantages, the possibility of bringing a jejunal segment subcutaneously to the esophagus in the neck was considered. The anatomical arrangement is outlined in Figure 4. If successful, this plan of attack would involve only two operations instead of four and thus shorten the hospital stay. Also, far less scarring would be produced, and it was hoped that neither fistulas nor strictures would develop. Success with this method has been reported by Yudin[3] and Yurasov.[4]

It was believed advisable to carry out a series of animal experiments before attempting this procedure on patients. In planning these experiments, it was recognized that the blood supply of the small bowel in lower animals is less complicated than in human beings. Man has multiple vascular arcades in the intestinal mesen-

A

B

FIG. 2. A and B, both of these patients have had dermojejunal esophagoplasty. There is no scarring visible when the children are dressed.

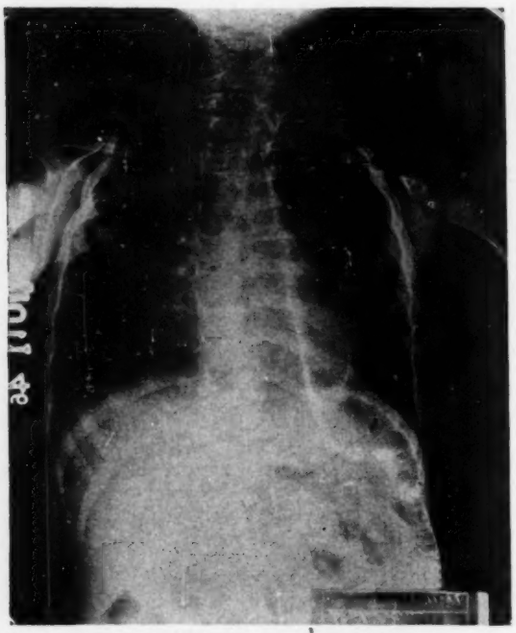

FIG. 3. *X*-ray of barium in dermojejunal esophagoplasty.

tery, and thus a richer anastomatic system than do canines, which possess only one arcade. This factor must be taken into account when appraising experimental results and considering their application to man.

In a series of six cats and six dogs the proximal jejunum was divided and the distal segment freed from its normal blood supply by ligating and dividing two or three intestinal vessels so that it could be brought up to the clavicle. Its intra-abdominal continuity was re-established by a side-to-side anastomosis. The subcutaneous end of the jejunum sloughed, and all of these animals were lost.

A second series of six animals was then subjected to the same procedure, except that in these experiments the jejunal segment used was much shorter, necessitating the dividing of only one intestinal vessel, so that the jejunum extended only 3 to 5 cm. above the costal margin. In all of these experiments the jejunum remained viable. These animals were under observation for two weeks to six months. At necropsy, in each case, there was no abnormality in the bowel except for adhesions to the chest wall and subcutaneous tissue.

To bring the jejunal segment up to the clavicle, and to insure its viability, a two-stage procedure was devised. During the first operation intestinal vessels, 10 cm. from the ligament of Treitz, were divided. The jejunum itself was then transacted

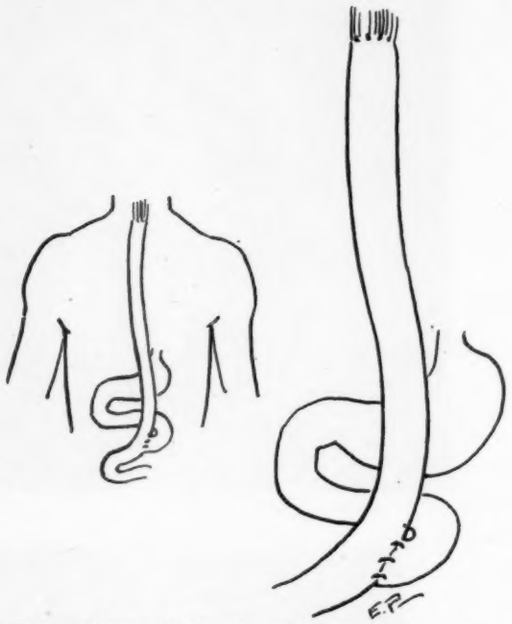

FIG. 4. Schematic drawing of anatomical arrangement in jejunal esophagoplasty.

proximal to the divided vessels. One set of intestinal vessels was left attached to the proximal end of the distal jejunum. A side-to-side anastomosis was then made below the point where the intestinal vessels had been cut. This section of jejunum was wrapped in fibrin film, to prevent the formation of adhesions. The blood supply to this segment of jejunum was now comparable to the blood supply of a rope graft, in that it was limited to the two ends. In ten to fourteen days the collateral blood supply had developed sufficiently to permit cutting the vessel at the proximal end, thus freeing the distal segment of jejunum so that it could be brought up to the clavicle subcutaneously.

A third set of animals, six in all, was subjected to the procedure described above. In each instance the jejunal segment was of sufficient length to extend to the clavicle, and maintained an adequate

blood supply. In each case the jejunum remained viable.

On the basis of these satisfactory experiments, we have carried out similar procedures on four patients. The children were prepared for operation by a five- to six-day course of sulfasuccidine therapy. The operative procedure was tedious, and required great gentleness. A midline incision from xyphoid to umbilicus was used. This gave a good exposure of the superior mesenteric artery and allowed the jejunum and its mesentery to be brought up in the deep cleft of the costal margin, rather than over the protruding ribs on either side of the midline.

The jejunum 10 to 15 cm. from the ligament of Treitz was selected, the peritoneum on each side of the mesentery below this point removed, and the intestinal vessels exposed down to the superior mesenteric artery. The artery and vein below the point of division of the jejunum were separately ligated as close to the superior mesenteric vessels as possible. These were divided, and the adjoining set of intestinal vessels exposed, ligated and cut.

To secure sufficient length of the jejunum to extend to the neck, it was necessary to cut a third set of vessels. To make sure that the end of the jejunal segment would remain viable, the third artery and vein were first occluded with rubber-protected clamps for ten minutes. If no great change in color took place in the jejunum, the vessels were ligated and divided. Two or three additional centimeters in length were obtained by ligating the small vessels as they entered the bowel at the proximal end of the divided distal jejunum. As the mesentery is the limiting factor, 2 to 3 cm. were gained safely by this maneuver. In three out of four cases a sufficient length of jejunum was gained to extend to the clavicle. In the fourth case it was necessary to supplement the jejunum with a short skin tube.

An end-to-side anastomosis of the jejunum was then made to restore continuity of the small bowel. The jejunum was brought up through the mesocolic shelf, an ample opening was left at the upper end of the abdominal wall to allow the jejunum to pass through. A tunnel was then made under the skin up to the esophagostomy and the jejunum brought up and anchored in place with one suture through the skin. (Figs. 5 and 6.) The end-to-end anastomosis of the jejunum to the esophagus was made ten to fourteen days later, using two rows of interrupted catgut sutures.

An anterior thoracic esophagus has been fashioned by this procedure, with variations, in the following four cases:

Case VI. (R. O.—275095). At four days of age this child was admitted to The Children's Hospital, and the diagnosis of atresia of the esophagus and tracheoesophageal fistula was confirmed. Dr. W. E. Ladd ligated the fistula, and on subsequent days performed a gastrostomy and marsupialized the esophagus to the neck.

When the little girl was two years of age, Dr. Ladd and the author started the construction of an anterior thoracic esophagus by raising a rope graft on the right side of the chest, extending through the old operative scar. When the lower end of the rope graft was transferred to the neck above the esophagostomy, the graft became discolored and the section down to the old scar was eventually lost in spite of trimming and re-implantation. The rope graft was then extended into the axilla and re-inserted above the esophagostomy. These five procedures consumed three months' time.

As the rope graft was still too short, it was decided to reverse the usual procedure and bring a jejunal segment up subcutaneously rather than to turn in a skin tube first. It was hoped that the jejunal loop could be brought up subcutaneously high enough on the chest so that the short rope graft would be sufficient to cover a turned-in skin tube. The jejunum was divided close to the ligament of Treitz, and three adjacent intestinal arteries divided. By careful freeing of the mesentery, sufficient length was obtained to the distal segment of the jejunum to bring it to the marsupialized esophagus. And end-to-end anastomosis was made between the jejunum and esophagus.

The child did quite well for twenty-four hours, then suddenly developed extensive infection of the anterior chest wall. The abdominal incision was opened, and it was found that a loop of jejunum had herniated between the abdominal wall and the jejunal segment leading to the esophagus, obstructing the blood supply to the bowel above this level. The gangrenous bowel was resected and the esophagus remarsupialized. The child recovered, and now awaits turning in of a skin tube to bridge the gap between the esophagostomy and the jejunum, which extends to just above the costal margin.

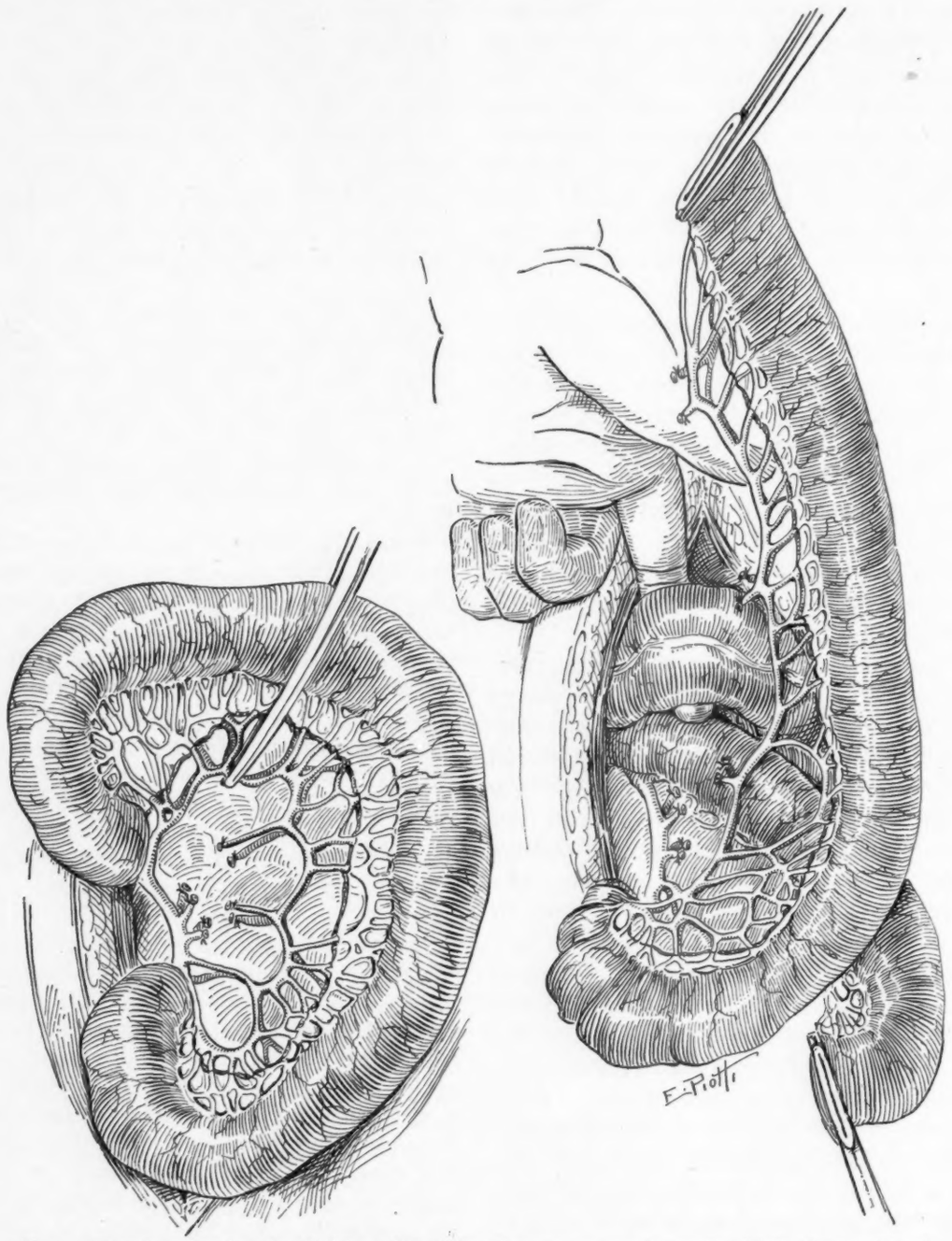

FIG. 5. Drawing showing the division of the jejunal mesentery and vessels which release a length of jejunum which can be brought up to the neck.

CASE VII. (D. C.—283160). Shortly after birth a diagnosis of esophageal atresia and

tracheoesophageal fistula was made. Dr. W. E. Ladd ligated the fistula, three days later performed gastrostomy, and followed this in four days by marsupialization of the esophagus.

Formation of an anterior esophagus was begun by the author when this little boy was twenty-three months old. On the basis of experimental work, it was decided to bring a jejunal segment to the esophagus in the neck by a two-stage procedure. The jejunum was divided 10 cm. below the ligament of Treitz. One intestinal artery and vein were left attached to the proximal end of the distal segment. The next three sets of intestinal vessels were divided, and an end-to-side anastomosis was made to restore continuity of the jejunum below the cut. The freed jejunum and mesentery were covered with fibrin film to prevent the formation of adhesions.

Seven days later the vessel going to the free end of jejunum was divided. Much to our dismay, the jejunum could be brought up only to a point 2 cm. below the marsupialized esophagus, because of the edema and consequent shortening of the mesentery. The jejunum was left in this position. Two months later, a short skin tube was turned in and covered with a Thiersch graft. One month later the jejunum was anastomosed to the lower end of the skin tube. A small fistula developed, which closed in ten days. One week after the patient was discharged the fistula re-opened, and continued draining for six weeks. It has now been dry for one month, and the child is taking small amounts of liquid by mouth.

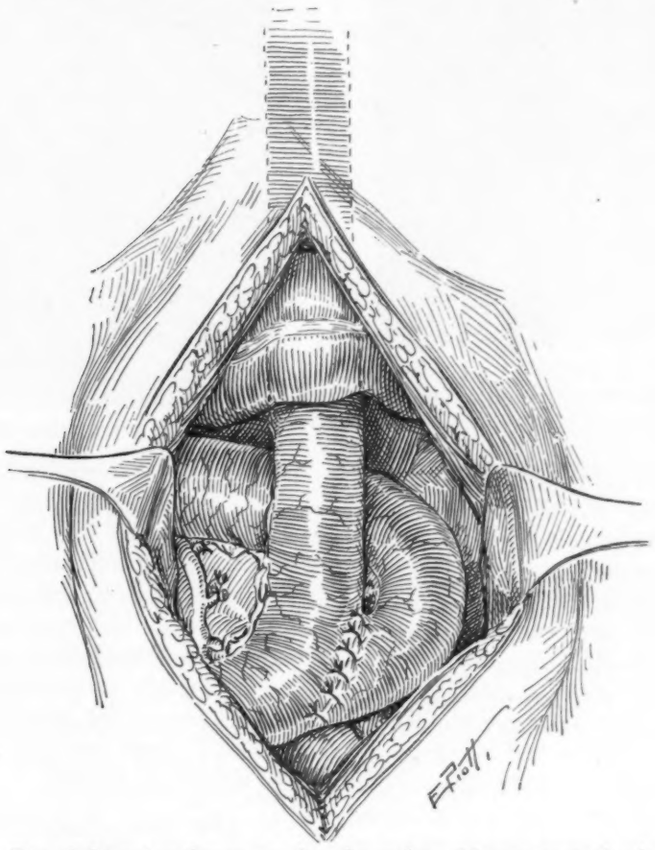

Fig. 6. Drawing demonstrating the end-to-side anastomosis of the jejunum which restores continuity of the intestinal tract after freeing a segment of jejunum.

Case VIII. (D. C.—294603). At three days of age this baby was admitted to The Children's Hospital with a diagnosis of atresia of the esophageal with tracheoesophageal fistula. The fistula was ligated, and at two- and three-day intervals the operations of gastrostomy and marsupialization of the esophagus were performed, by the author.

FIG. 7. Photograph of patient with jejunal esophagoplasty. The only scar on the neck and chest is the incision above the left clavicle.

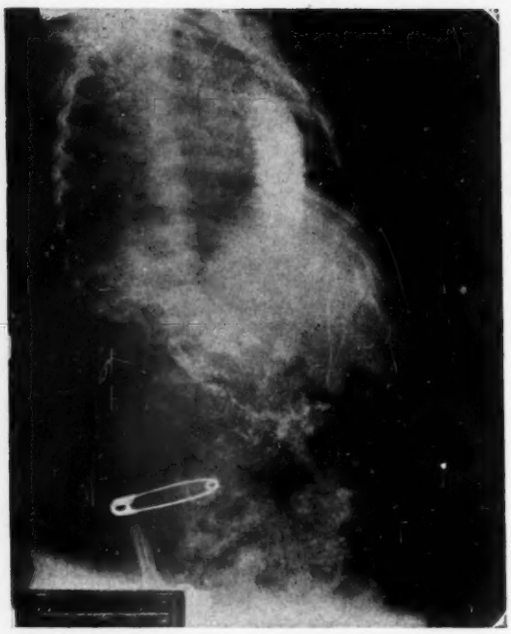

FIG. 8. *X*-ray of barium in jejunal esophagoplasty.

Starting when the little girl was thirteen months old, an anterior jejunal esophagoplasty was performed in two stages: First, three intestinal arteries and veins 10 cm. from the ligament of Treitz were carefully freed and divided. The jejunum proximal to these was divided. The jejunum distal to the point of division was thus freed and could be brought subcutaneously to the marsupialized esophagus. Four weeks later an end-to-end anastomosis was made between the esophagus and jejunum.

The postoperative course was complicated by some infection in the subcutaneous tissue at the site of anastomosis. This cleared after a slight amount of drainage. As this child had not been taking fluids by mouth, it was necessary to train her to eat. At the time of discharge she was taking one ounce of fluid three times daily. Roentgenograms revealed an adequate stoma at the esophagojejunal anastomosis. (Figs. 7 and 8.)

CASE IX. (L. B.—286401). At eight days of age, this child had a series of operations by Dr. W. E. Ladd, consisting of ligation of a tracheoesophageal fistula, gastrostomy and marsupialization of the esophagus to the neck.

When she was two years old, the author began the formation of an extrathoracic esophagus. At the first operation the patient's color was poor, and her blood pressure fell to below 80 systolic. This was presumably due to anesthesia, as little more than an abdominal incision was accomplished. Three days later, under cyclopropane anesthesia rather than ether, the child did well and a segment of jejunum was brought up to the marsupialized esophagus. Subsequently, an anastomosis was made between the esophagus and the jejunum. Ten days postoperatively a fistula developed at the site of the anastomosis. The fistula continued to drain for eight weeks after the child was discharged, but she is now beginning to take liquids by mouth.

In the first case of jejunal esophagoplasty, failure was due to two factors: (1) The bowel was anastomosed to the esophagus at the first operation, which invited infection, as an open anastomosis was made in an area of extensive freeing of subcutaneous tissue; (2) the jejunum was not carefully sutured to the peritoneum where the bowel passed through the abdominal wall. A loop of small intestine herniated alongside the jejunum and by pressure reduced the blood supply, so that the jejunum became devitalized and required removal.

The next case was done in two stages. During the first operation three intestinal vessels were ligated and the bowel supplied by these vessels was wrapped in fibrin film to prevent adhesions. At the second stage

the jejunum was brought up under the skin of the chest. The edema and swelling of the mesentery prevented the jejunum from extending to the neck. The 5 cm. gap between the jejunum and the esophagus had to be bridged with a skin tube covered with a Thiersch graft.

In the last two cases, the jejunum was brought up to the neck in one stage, and at a second operation the jejunum was anastomosed to the esophagus. Both of these children developed small fistulas at this anastomosis, but the fistulas closed spontaneously. There is no doubt that this is the procedure of choice, and that it presents far less trouble than had been anticipated.

Jejunal esophagoplasty, as described in the last two cases, has several advantages. Only two operative procedures are required, and the hospital stay is relatively short. The only disfigurement to the patient is a short incision at the base of the neck. Furthermore, it is hoped that fewer strictures will develop in this form of esophagoplasty.

The dangers of this operation can be reduced to a minimum if mobilization of the jejunum is carried only so far as it retains a good color. In the instances in which the jejunum is not of sufficient length to extend to the esophagus, the intervening gap can be spanned by a skin tube. Before such a skin tube is made, the jejunum should be marsupialized to the skin below the esophagus. Two or three months later, when it has been demonstrated that the jejunal opening to the skin is adequate, a skin tube may be turned in. Should the jejunal opening to the skin become stenotic, it can easily be enlarged before a skin tube is turned in.

SUMMARY

Eleven cases of esophagoplasty are reported. There were two deaths; one was directly attributable to preceding operations and the second probably was not related to the previous surgical procedures.

In our experience, dermo-esophagoplasty has proved to be extremely time-consuming, fistulas are troublesome, and strictures at the dermogastric juncture are difficult to prevent or correct.

The use of a skin tube and a segment of jejunum, connecting the dermic tube to the proximal small intestine, by-passing the stomach, is an improvement over a skin tube connecting the upper esophagus to the stomach. The reflux of irritating gastric juice is obviated, and fistulas complicated the postoperative course in only two out of five cases. Strictures occurred in only two out of four cases.

Jejunal esophagoplasty is the operation of choice. Less time is consumed in its completion, and there is minimal disfigurement. Fistulas continue to be a problem and it is too early to say whether strictures will develop.

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COMPOUND DEPRESSED FRACTURES OF THE SKULL INVOLVING THE SUPERIOR LONGITUDINAL SINUS*

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THE importance and seriousness of a compound fracture of the skull involving the large venous sinuses of the brain must be fully appreciated before undertaking to operate upon such patients. In particular a compound depressed fracture of the skull involving the superior longitudinal sinus is fraught with great danger. This danger was most vividly described in 1882 by Wharton[1] who near the end of the operative report of his first case of this type stated the following: "Several fragments were removed with the elevator and bone forceps, and upon the removal of the last fragment there was a furious gush of venous blood. Attempts were made to control the bleeding by grasping the walls of the sinus from which it arose with artery forceps, but were ineffectual and the patient promptly succumbed." Wharton profited by this tragic experience. His next four operative cases of compound fractures involving the superior longitudinal sinus not only survived but recovered fully.

In 1901, Wharton presented a paper on seventy collected cases of wounds involving the great venous sinuses of the brain before the Philadelphia Academy of Surgery. Of these, forty cases showed injury to the superior longitudinal sinus with a mortality of 60 per cent.

Since the communication by Holmes and Sargent[2] on injuries to the superior longitudinal sinus during World War I very few reports have been published on this subject.

In 1939, Carlucci[3] reported on one case of injury to the superior longitudinal sinus accompanying a midline depressed skull fracture. There was progressive weakness of the right lower limb. As one of the depressed skull fragments was elevated there was profuse bleeding from the lacerated sinus. The wound was packed and on the following day both lower limbs were spastic. Following the removal of the packing several days later, the spasticity of the lower extremities disappeared. In a collective review of extradural hemorrhage in 1942 Gurdjian[4] included four cases of dural sinus hemorrhage treated surgically. Pickles[5] in a study of 104 consecutive patients with compound fractures of the skull had no case of injury to the superior longitudinal sinus. In a report by Munro[6] of 215 cases of compound fractures of the skull only one patient had involvement of the superior longitudinal sinus.

The recent experimental studies by Beck and Russell[7] on acute thrombosis of the superior longitudinal sinus in rabbits, cats and dogs have shown rather surprising results. To occlude the sinus they used ligation, irritant coagulants, thrombin, muscle and cotton wool, but in all instances they failed to produce complete thrombosis. These attempts of obliteration of the superior longitudinal sinus were followed by varying degrees of organization and recanalization, and most surprising no functional disturbances. The most likely explanation for the difference in response in man and in the animals used is that in the animals there are not nearly as many cerebral veins emptying into the superior longitudinal sinus and that collateral circulation is adequate to compensate rapidly for such venous interference.

It is timely, therefore, to focus attention again on this serious clinical problem of acute injury and compression of the superior longitudinal sinus. The following reports on two successfully treated patients

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Fig. 1. Case 1. Anteroposterior view showing depressed fracture over the superior longitudinal sinus.

have been very instructive and illustrate the value of planned treatment for this type of injury.

CASE REPORTS

Case 1. On October 10, 1937, A. S. a ten year old negro boy was admitted to the emergency room of Mt. Sinai Hospital with a laceration of the scalp over the left parietal region. About one hour before admission he was struck over the head by a falling beer bottle and was rendered unconscious for about a minute. There was only moderate bleeding from the scalp.

While being examined the patient suddenly developed a right-sided Jacksonian seizure with clonic movements involving the right arm which then spread to the right leg. This lasted for about one minute and after a brief interval he was fully conscious.

Examination then showed an alert, bright young negro boy with an angular scalp laceration in the parietal region measuring 2 by 7 cm. just to the left of the midline. There was almost complete paralysis of the right leg with marked hypalgesia below the iliac crest. Light touch, vibration and position sense were intact. The deep reflexes were active and equal, but the abdominals and cremasteric responses were absent on the right. There was no Babinski sign.

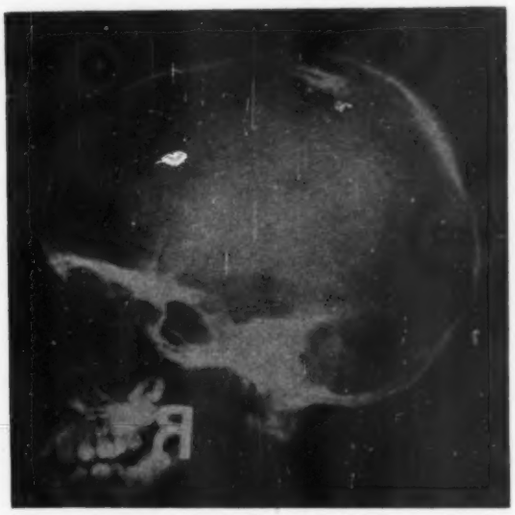


Fig. 2. Case 1. Lateral view showing postrolandic position of the depressed fracture.

X-ray films of the skull (Figs. 1 and 2) showed a comminuted depressed fracture of the left parietal bone, 5 cm. in diameter extending to the midline. It was realized that the fracture involved the superior longitudinal sinus.

After the scalp was shaved and all preparations completed for an immediate transfusion, novocaine was infiltrated at the site of the scalp laceration. The wound edges were débrided and a generous exposure made of the depressed skull fragments. These were gently elevated and removed one by one starting furthest away from the longitudinal sinus. A large piece of muscle was obtained and held in readiness. As the last bone fragment which pierced the longitudinal sinus was removed there was a gush of blood, but the muscle placed over the tear easily controlled the bleeding. The muscle was left in place and the scalp carefully closed over it in double layer.

The postoperative course was smooth. Five days after the operation sensation of the right leg was normal and early movement was observed in the right hip. Within a week there was movement of the right leg but no movement in the foot or toes. After several days there was evidence of returning function in the right foot. When allowed out of bed he walked with a slight limp. On November 4, 1937, three weeks after operation he was discharged.

Repeated follow-up examinations over a period of six years showed complete return of motor power and no sensory impairment. He was free of symptoms or seizures and considered his health excellent.

Fig. 3. Case II. Depressed fracture crossing vertex over the superior longitudinal sinus.

Case II. On July 21, 1946, at 9:30 P.M. a thirteen year old negro boy was brought to Mt. Sinai Hospital in a semi-conscious condition. About a half hour earlier while walking along the street he was struck over the right side of the head by a falling brick which was thrown from an upper story window.

Examination showed a young, irritable, restless colored boy who from time to time cried out and then fell asleep. However, he could be easily aroused. Over the right parietal region there was a jagged scalp laceration about 4 inches long with driven in dirt and hair, and through which there extruded small bits of brain tissue. There was no stiffness of the neck, but motion of the head caused him to scream out bitterly. The pupils were equal and the fundi were normal. No facial weakness could be demonstrated. There was a left hemiplegia with anesthesia involving the left leg only. The abdominal reflexes on the left were diminished and the Babinski sign was positive on the left. When aroused the patient complained of pain over the front of the neck and down both arms. The pulse was 93 per minute, blood pressure 76 systolic, 50 diastolic.

X-ray films of the cervical region showed no fracture or dislocation, but *x*-ray films of the skull (Figs. 3 and 4) showed a comminuted depressed fracture of the right postparietal bone overlying the superior longitudinal sinus.

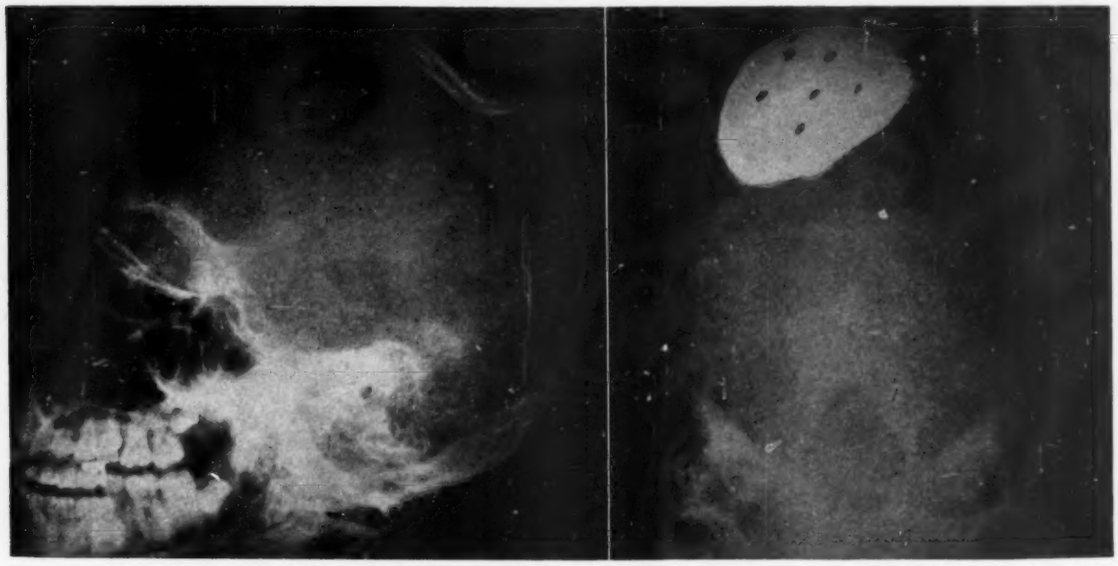
The patient was given 50,000 units of penicillin, 500 cc. of plasma and tetanus anti-toxin. Blood grouping was done and blood obtained for immediate transfusion.

A large area of the scalp was shaved and all preparations were completed to cope with the emergency. The patient was given intravenous sodium pentathol anesthesia. Novocaine was infiltrated in the region of the scalp wound. The wound was then débrided and the depressed comminuted skull fragments were gently elevated and removed one by one beginning at a point furthest from the longitudinal sinus.

The extruding devitalized brain tissue was removed by suction and the bleeding controlled with electrocoagulation. A crescentic dural tear 4 cm. long was repaired. A fair sized block of muscle was kept within easy reach preparatory to the removal of the depressed skull fragment overlying the superior longitudinal sinus. When the fragment was removed the tear in the sinus was immediately sealed with the muscle and held in place. Fortunately, all the bleeding was thereby controlled. The scalp was then closed in double layer. Penicillin therapy was continued.

For several days after the operation the patient was quite irritable and troubled chiefly with pain in the neck and chest. There was no change in the hemiplegia and the Babinski sign on the left was still positive. On the fourth postoperative day the patient had a convulsion on the left side. He was placed on anti-convulsive therapy. Lumbar puncture showed slightly xanthochromic fluid under 50 mm. of water pressure. The fluid showed 625 red blood cells but no leukocytes. Two days later the spinal fluid was crystal clear under 112 mm. of water pressure. Still there was no motion in the left arm or leg, but marked dysesthesia of the left leg. The Babinski sign on the left remained unchanged.

On July 29, 1946, eight days after the operation the first signs of motion appeared in the fingers of the left hand. From then on improvement continued. The patient's personality showed a decided change. He became cheerful, quiet, talkative and at times jovial. By the end of the fourth postoperative week he was able to walk with slight assistance. Sensation was practically normal. Fine finger movements in the left hand were still sluggish.



Figs. 4 and 5. Case 11. Postrolandic position of the depressed fracture. Showing tantalum plate covering the skull defect.

Because of the large skull defect over so vulnerable an area a cranioplasty was done using a tantalum plate. (Fig. 5.) One week later in spite of penicillin therapy and apparently good wound healing a fluctuant mass appeared under the scalp at the operative site. The regional cervical glands were enlarged and tender. The patient had moderate fever. Aspiration of the mass yielded 12 cc. of dark hemorrhagic fluid which upon culture subsequently showed a growth of Staphylococcus aureus. On September 25, 1946, the patient was discharged at which time he walked with a slight limp, dragging the left foot. Power and motion in the left arm was much improved. The deep reflexes on the left were hyperactive. Babinski sign on the left was still positive. Except for slight impairment in position sense of the toes of the left foot no sensory abnormality could be demonstrated.

A follow-up examination three months later showed equal strength in both arms, some weakness of the left leg, chiefly concerned with flexion and extension of the foot, some weakness in flexion of the left knee and moderate atrophy of the left calf and anterior tibial muscles. Babinski sign was still present on the left. There was no sensory abnormality.

COMMENT

These two patients present several points of clinical interest. They were both seen within a comparatively short interval after the injury and offered an excellent opportunity to observe the changing neurological signs. From the history, clinical findings and *x*-ray films of the skull injury to the superior longitudinal sinus was suspected immediately. In both patients the compression of the sinus was acute and posterior to the rolandic point; that is posterior to the junction of the rolandic venous trunk with the superior longitudinal sinus. Although there was no opportunity to inspect the cerebral cortex adjacent to the wounded longitudinal sinus it may be assumed that the pathological findings were similar to those described by Holmes and Sargent.[2] The clinical course in our two patients closely paralleled their recovered cases. In the cases that came to autopsy Holmes and Sargent found that the pathological condition was chiefly that of stasis as the result of acute venous obstruction. The veins which normally entered into that portion of the injured sinus was swollen, firm and congested. The segment of the brain which was drained by these veins was edematous, flattened and showed minute petechial hemorrhages most prominently in the subcortical white matter.

The return of function in both patients followed a definite pattern. It started in the most peripheral parts of the upper limb,

gradually improving in segments approaching the shoulder, and in the most proximal parts of the lower extremity with improvement progressing peripherally. As has been pointed out by Merwarth[8] in the syndrome of the rolandic vein, progression of functional return in these patients corresponds with our knowledge of cortical localization. Rigidity of the limbs was not noteworthy in either patient. Sensory disturbance cleared very rapidly. There was only temporary dysfunction of the bladder and rectal sphincter. Return of all function was complete in the first patient and the course in the second patient promises a similar result.

TREATMENT

In the treatment of a compound fracture of the skull involving the superior longitudinal sinus one must be acutely aware of the dangers that lie ahead and prepare accordingly. On two separate occasions I witnessed the failure of the surgeon to appreciate fully the danger and magnitude of the problem before him. In one case, following the removal of the impacted skull fragment from the tear in the sinus there was a violent gush of blood followed by prompt respiratory cessation and death. In the second patient the tear in the sinus was smaller and the bleeding was finally controlled by packing. There followed a paraplegia of the lower extremities which fortunately cleared up several weeks after the removal of the packing.

When one becomes aware from the clinical examination and studies of the *x*-ray films that one is dealing with a compound fracture of the skull involving the superior longitudinal sinus, it is well to bear in mind the following: (1) That the sharp edges of the depressed bone fragments may have torn the thin walls of the sinus. These walls are not so readily collapsible because they are really fixed folds of the dura; (2) that not infrequently the bone fragment, usually the inner table of the depressed skull overlying the sinus, may be displaced underneath and so impacted as to plug the rent made in the sinus. One should therefore not be misled by the very little bleeding encountered at the time of admission or during the early phases of the elevation and removal of the depressed skull fragments; (3) that lacerations of the anterior portion of the superior longitudinal sinus differ from those of the posterior portion of the sinus. The anterior portion is not as adherent to the underlying bone so that with an anterior tear an extradural hematoma is likely to occur, whereas with a posterior tear of the superior longitudinal sinus a subdural hematoma is apt to follow. (4) Occasionally with extensive tears of the sinus air embolism may readily occur and lead to sudden death.

To meet the challenge of impending violent hemorrhage from a wound of the superior longitudinal sinus, the plan of treatment must be simple, systematic and swift. A large area of the scalp should be shaved, an infusion must be functioning well and one or two units of compatible blood must be on hand. A fairly generous block of muscle from the leg or elsewhere must be secured and made easily available on the operating table. Furthermore in the operative procedure one must have a generous exposure of all the depressed skull fragments with sufficient space to permit full and clear view of the injured portion of the sinus. After the débridement of the wound edges the depressed skull fragments farthest away from the injured sinus should be elevated and removed first. Gradually and slowly more of the fragments are lifted and removed with a rongeur, taking little bone at a time. The area of the injured sinus is left for the last. With the entire surgical team on the alert and the transfusion flowing, the last impacted skull fragment is removed and the tear in the sinus immediately sealed off with the muscle. The muscle is held in place with suction over compressed cotton. Further marginal leakage may be controlled with small stamps of muscle, gel foam or oxycel. It may be necessary to suture the muscle to the adjacent dura to aid compression and

prevent slipping. After satisfactory hemostasis the scalp is closed in a double layer.

The other procedure has proven satisfactory in the two patients already reported. Others have met this problem somewhat differently and in a variety of ways. On occasions the impacted bone in the sinus has been left undisturbed. This of course carries the risk of infection, osteomyelitis, thrombophylebitis, meningitis, brain abscess and the like. To control the bleeding from the injured venous sinus measures have been used which include compression of the sinus with gauze or packing, lateral suture of the sinus, ligation of the sinus, closure of the sinus tear with silver clips and under extreme circumstances clamping the sinus with forceps and allowing them to remain in place for three to six days.

SUMMARY AND CONCLUSIONS

Two successfully treated cases of compound depressed fractures of the skull involving the superior longitudinal sinus are presented emphasizing the danger that lies ahead when one is faced with such a serious problem and stressing the value of a planned operative procedure in meeting this danger.

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GALLSTONE ILEUS

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GALLSTONE ileus is of interest because of its rarity and of importance in that its early recognition and correction by surgical intervention results in a marked decrease in mortality. This holds true since the chief complication of intestinal obstruction, namely, gangrene of the involved gut is always lacking until the late stages of this condition. Yet because of its rarity it is but seldom diagnosed preoperatively being recognized only at autopsy or upon exploration of the abdomen for small intestinal obstruction.

Obstruction of the small intestine due to the presence of gallstones was first reported by Bartholin in 1654.[10] The British Medical Association reported twenty-eight cases of gallstone ileus out of 3,064 cases of obstruction or less than 1 per cent.[1] Various reports estimate that it is the cause of from 1 to 2 per cent of all intestinal obstruction.[3] Until 1925 some 400 cases were all that had appeared in the literature.[2]

Women are more prone to gallstone ileus than men by the ratio of 15:1, while gallbladder disease with stones is only two to three times as common in women.[3] No explanation is presented for this inconsistency.

The average age of a series of seventeen cases[3] was sixty-six years, the youngest in the fifties and the eldest in the nineties. The incidence late in life with the usual late diagnosis is responsible for the high mortality rate variously estimated from 50 to 70 per cent[5] the first figure being from a series of twenty-eight and the second from a series of forty-seven cases. The mortality rate is also increased by excessive surgery when too much time and trouble are spent in locating the source of the offending stone and attempting to care for the pathological condition found about the gallbladder or common duct.

Gallstones may reach the intestine by one of two ways: first, passage by way of the common duct and ampulla of Vater and second, by passage through fistulous tracts between the gallbladder or the bile ducts and an adjacent viscus. This latter way is by the sequence of cholelithiasis, erosion and ulceration, pericholecystitis with formation of adhesions to adjacent structures and perforation and fistula formation through the adhesions. In a series of seventy cases of gallstone ileus in which the route of the stone could be traced thirty-six occurred through a cholecystoduodenal fistula, twenty-five through a cholecysto-ileac fistula, one through a cholecystocolic fistula and seven through a choledochoduodenal fistula.[2]

The size of reported stones causing obstruction is remarkable inasmuch as it is believed that stones up to 2.5 cm. will pass the ileocecal valve.[6] The largest stone reported to the author's knowledge was 6 cm. in diameter and obstructed the duodenum; the largest stone reported in a series operated upon at the Massachusetts General Hospital[3] was 5 cm. in diameter and obstructed the terminal ileum. It is assumed that these reports refer to the smallest diameter of the stones because they were discussed from the viewpoint as being possible causes of intestinal obstruction.

The symptoms are those of any obstruction except that they may be fleeting, transient and recurring. Pain, vomiting and obstipation are usual but distention may never become prominent as some gas may pass the stone. Also the spasm of the intestine about the stone may alternately relax and recur; however, as the stone passes down the narrowing lumen of the intestine complete obstruction is usually the end result.

The diagnosis may often be clouded by the brevity of the obstruction since the stone may often act in a ball-valve manner. The stones may even lie in the intestinal tract for some time without causing symptoms thus obscuring the history of previous gallbladder attacks. Several writers such as Vidgoff[7] and Skemp and Travnicek[8] emphasize the fact that frequently the patient has had no preceding symptoms of gallbladder disease. One authority states that 75 per cent of stones which pass from the gallbladder by way of fistulous tracts have never caused symptoms. Roentgen ray examination may be of value in showing the shadow of the suspected stone.

Treatment is surgical and should, as in any case of intestinal obstruction, "be based on suspicion rather than on certainty."[9] Intestinal resection is almost never necessary. If possible the stone should be pushed up the healthy intestine and delivered from the wound, carefully packed off and a longitudinal incision made to free the stone. This incision should be closed under proper asepsis, transversely to obviate the possibility of the later development of a stricture. Drainage is usually not necessary. Ileostomy above the site of the obstruction is rarely if ever indicated and in most instances will add to the mortality. Preoperative and postoperative use of intravenous minerals, fluids and duodenal suction by the Wangensteen method are of prime importance.

CASE REPORT

Mrs. E. R., a white female, aged sixty-two years was first seen because of abdominal pain and nausea. Severe cramping abdominal pain had been first noticed on the preceding day. The patient thought that it originated in the right upper quadrant of the abdomen and passed down across the midline to the left lower quadrant. This pain was paroxysmal. Nausea was intense and vomiting severe, the vomitus consisting chiefly of bile. The bowels had moved normally on the day of onset of the pain.

No history of any similar attacks could be elicited. For the preceding year she had had "gas on the stomach" two or three times monthly which she stated had been relieved by bicarbonate of soda. She admitted that "fat foods" caused gas and a feeling of fullness. About twenty years previously all her "female organs" and appendix were said to have been removed. Chronic constipation had been troublesome for many years. Bronchopneumonia two years before admission was the only previous illness of any consequence.

On physical examination the patient was seen to be an elderly, white female, severely nauseated, vomiting bile at frequent intervals and apparently suffering excruciating pain. Her temperature was 98°F., respirations 20 and pulse 80. She was 5 feet 5 inches tall and weighed 170 pounds. No cardiac or respiratory pathological conditions were noted. Abdominal examination revealed moderate tenderness in the right upper and left lower quadrants, particularly in the latter. No masses, rigidity or distention were demonstrable. Pelvic examination revealed the cervical stump with a large cervical polyp. The rectum was found to be empty and presented no pathological disorder.

A tentative diagnosis of cholecystitis with stones or partial obstruction was made. The patient obtained no relief from morphine sulfate, gr. ¼ hypodermically but was later relieved by a hypodermic injection of the antispasmodic trasentin.

On the second day all symptoms returned in their original severity. Oral trasentin gave no relief from pain but a morphine injection did relieve her to some extent. An enema was given with fair results. The temperature, pulse and respiratory rate were normal. Her blood pressure was 134/84. The physical findings were as before with the addition that the patient was somewhat dehydrated. Peristalsis was normal in activity. Emesis was thick and green. An enema was given and returned uncolored.

The blood count was red blood cells, 4,130,000; hemoglobin, 85 per cent; white blood cells, 14,000; a differential count of 87 per cent neutrophiles (no shift to the left), 1 per cent eosinophiles and 12 per cent lymphocytes. A voided specimen of urine showed a specific gravity of 1.021; pH 6.0; albumin, two plus; 20 to 25 erythrocytes per high power field and innumerable pus cells.

On December 29th the condition was essentially unchanged. Intravenous fluids were given. Later in the day abdominal distention was noted for the first time. A flat plate roentgenogram of the abdomen was made which revealed a large shadow in the region of the right kidney pelvis. This was reported as a large staghorn stone of the right kidney. A cholecystogram was later done with failure of visualization of the gall-bladder. A diagnosis of chronic gallbladder disease was made from this finding.

The pain was considerably less on the fourth day but with residual soreness in the left lower abdominal quadrant. Distention was still present but there was no deviation from normal peristaltic activity. As the pathological condition found was not sufficient to explain the symptoms a gastrointestinal roentgenographic study was made. Positive excerpts from the report are as follows:

"The duodenal bulb filled readily and was of average size but peculiar shape and with a long finger-like process of barium extending up from the duodenal cap about 3 cm. in length and 1 cm. in width which presented a "Y" shaped division. This is presumably barium escaping into a dilated common duct and hepatic ducts. At three hours a large portion of the barium meal was still in the stomach and what appeared to be greatly dilated and distended loops of small intestine were seen in the left side of the abdomen. A lesser number were seen in the right side of the abdomen showing a thin shadow of barium. No barium had reached the cecum. Six-hour observation revealed findings almost identical with the three-hour films.

Diagnosis: Small intestinal obstruction (lower ileum). Incompetent sphincter of Oddi with entrance of barium into the common and hepatic ducts."

On the fourth day under general gas and ether anesthesia a low midline incision was made. The lower ileum was adherent to the under surface of the old operative scar. In freeing the adhesions the terminal ileum which was here very thin and dilated was accidently opened. Proximal to the adhesion a large foreign body was found in the lumen of the intestine. The ileum was incised, the stone removed, the wounds in the intestine sutured transversely and the abdomen closed in layers. A Penrose drain was inserted into the abdominal cavity; the upper abdomen was not explored.

The patient made a fairly uneventful recovery. She was treated postoperatively with constant duodenal suction and intravenous fluids. Normal bowel function returned rapidly. The wound drained about three weeks and healed without other complication.

The pathological report was as follows: "An elongated stone 3.9 cm. in length and 1.9 cm. in diameter presenting a yellowish-gray mottled surface and on crushing portions of the stone a dark reddish-black surface is observed. This stone is definitely not a phytobezoar or a trichobezoar but is a typical gallstone. It is somewhat difficult to visualize the method by which this large stone could pass the cystic and common ducts.

Diagnosis: Cholesterol stone originating in the gallbladder or bile ducts."

COMMENTS

The case presented here shows typical fleeting or at least slowly progressing signs of obstruction. The proper diagnosis was hindered by the finding in routine studies of conditions which by themselves could have produced the symptoms presented by the patient. Distention was never marked and feces were passed with enemas on several occasions. This is explained by the ball-valve action of these stones commented on earlier in this paper.

The unusual point about this case which causes it to be reported is the mode of transmission of the stone into the intestine. In all cases reviewed where the mode of transmission was known the stone entered the intestine by way of fistulous tracts; where the mode of transmission was not known it was assumed to have been by way of fistulous tracts. In this case there is presumptive evidence that the stone, large enough to cause intestinal obstruction, passed the common duct and the ampulla of Vater possibly by ulcerating through the latter. First, no fistula is demonstrable by *x*-ray; second, *x*-ray study shows a reflux of barium under very slight pressure into the common bile duct and even into the hepatic ducts all of which are enormously dilated.

It is not possible to judge whether the right upper quadrant pain of the early part of the illness was due to the passage of the stone from the common duct or whether the stone had passed long before. Due to the absence of jaundice and other signs of biliary obstruction, the author believed that the stone had entered the intestine previous to the present illness. In all probability it would have passed on to the ileocecal valve and possibly into the cecum but for the kinking of the ileum caused by the adhesions beneath the old midline incision. It was deemed unwise at the time of operation to investigate the conditions about the gallbladder, biliary ducts and ampulla of Vater.

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To increase exposure, especially in the upper abdomen, a transverse incision may be made through the skin and anterior and posterior sheaths of the rectus muscle at right angles to a median incision. This type of exposure may be indicated in certain operations upon the gallbladder, stomach, pancreas, spleen, and transverse colon.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

TORSION OF THE SPERMATIC CORD

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TORSION of the spermatic cord, sometimes incorrectly referred to as torsion of the testicle, is a condition caused by a twisting of the spermatic cord and the testicle on its long axis resulting in partial or complete embarrassment of the blood supply to the testicle. It may be acute or chronic. The chronic type is known as recurrent.

Frequency. Torsion of the spermatic cord occurs much more frequently than we are led to believe by an examination of the literature. This false impression is gained because many recognized cases have not been reported and many cases have not been recognized. The first case to appear in the literature was published by Delarsiavue in 1840. By 1936, Abeshouse was able to collect 350 cases of which twenty-four were bilateral. A review of the literature by Ewert and Hoffman[19] up to July, 1943, revealed a total of 489 cases of which twenty-six were bilateral, and these authors added four more cases making a grand total of 493 cases up to that time. A review of the English literature since this publication reveals one case presented by Mohardt[18] associated with a tumor of the testicle and a case of bilateral torsion reported by Moulder.[20]

Although torsion has been known to occur in the newborn child and in men who have reached seventy years of age, the great majority of cases occur in young individuals. Abeshouse reports the average age as being 17.7 years. Torsion is found as frequently in the right as in the left testicle. Cryptorchidism is found in 0.1 per cent to 1.0 per cent of the general male population. Since torsion is found as often in these patients as it is in patients who have fully descended testes, it is apparent that undescended testicles predispose to this condition.

Etiology. Torsion of the spermatic cord does not occur in the normal testicle. The causes of torsion may be divided into predisposing and exciting. Predisposing causes are as follows: (1) Abnormally large tunica vaginalis with a high investment of the spermatic cord; (2) abnormally long or absent gubernaculum testis; (3) separation of the testicle from the epididymis; (4) inversion of the testicle with the globus major and the globus minor in reverse positions; (5) abnormal attachment of the mesorchium to the lower pole of the testicle which maintains the organ in an almost horizontal position and (6) cryptorchidism. The exciting cause is a spasm of the cremaster muscle which is generally brought on by indirect trauma of a mild degree but the condition has been known to occur while sleeping as reported by Lynch and Thompson[3] and Kretschmer.[1]

Numerous instances of small testicles have been noted during routine physical examinations. This may have been caused by (1) the undeveloped testicle which is small, soft and insensitive; (2) the atrophic testicle which may be classified as *mumps* where the testicle is small, soft and tender; *trauma*, direct or operative and *torsion*. The testicle of trauma and torsion is hard, nodular and insensitive as has been shown by Ormond.[6]

Pathology. The actual twist may be intravaginal or extravaginal. The intravaginal type is less frequent and occurs in those patients who have a large tunica vaginalis which is invested high on the spermatic cord. In this type the twist occurs within the sac of the tunica vaginalis and so the tunica is not involved in the process. The extravaginal torsion occurs anywhere between the internal inguinal ring and the attachment of the tunica

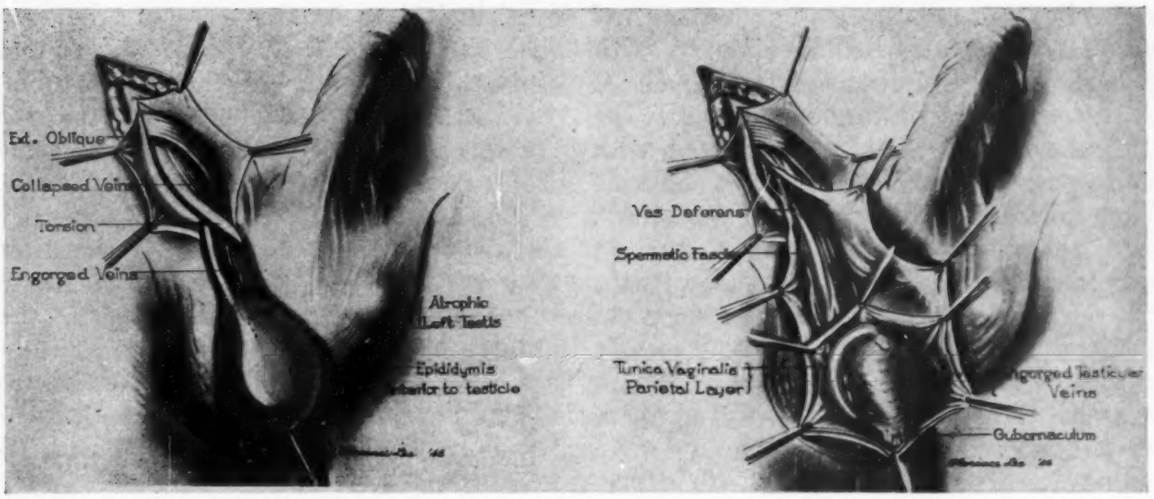

FIG. 1. A, the aponeurosis of the external oblique is opened to show the torsion and the dilated veins. Note the atrophic left testicle; B, the spermatic fascia and the cremaster muscle have been split open and the torsion corrected. The tunica vaginalis has been opened and is left open. Note the long gubernaculum attached to the tunica.

vaginalis to the spermatic cord. The direction of the twist is generally toward the midline. The right testicle turns clockwise and the left turns counterclockwise.

The pathological condition found at operation depends upon the amount of embarrassment to the blood supply and the length of time expired since the onset. The testicle and cord may have twisted any number of degrees; two or three complete turns may have taken place. The veins, because of their thinner, softer walls and lower intraluminal pressure will become obstructed before the arteries. This results in venous engorgement below the site of the twist which progresses to thrombosis and ecchymosis of the spermatic cord and testicle. Edema appears in the cord, epididymis and testicle. This edema extends up to the site of the twist where it is sharply delineated from the normal looking spermatic cord proximal to the torsion. The veins in the proximal portion are empty and flattened. The lesion in the testicle goes on to interstitial hemorrhage, necrosis and gangrene. The appearance of the testicle varies from a gray cyanotic hue to a deep, green-black. Its vessels are engorged. The cavity of the tunica vaginalis contains a varying quantity of fluid under pressure which may be clear and straw colored or dark and bloody. In the event the lumen of the artery should become obstructed at the onset, the pathological changes will be those of an infarct.

In the recurrent cases, those which have successful manual detorsion accomplished or those which undergo spontaneous detorsion the findings will depend on how many attacks the patient has had and how much damage was done during each attack. Each episode of torsion causes some destruction of the testicle. The destroyed testicular tissue is replaced by fibrous tissue.

Symptoms. The symptoms vary according to the location of the testicle, which may be in the abdomen, in the scrotum, or in any interval position and according to the amount of torsion. There is severe testicular pain and tenderness which comes on after indirect trauma. Walking is difficult and the patient leans forward, moving slowly with the legs held apart to keep the scrotum and testicle from striking against the thighs. He sits down very slowly and carefully generally preferring to sit on the contralateral buttock. He lies on the examining table with his knees drawn up, particularly the one on the affected side. The pain

may be referred to the abdomen and simulate an abdominal emergency. This is particularly true in cases of undescended or incompletely descended testicles. The abdominal pain may be associated with nausea and vomiting. Individuals suffering from torsion of the spermatic cord may, but generally do not exhibit nausea, vomiting, shock, fever and leukocytosis. Beare[13] states that repeated attacks of testicular pain without urinary infection is diagnostic of this condition. Physical examination reveals a slightly swollen, very tender testicle situated high in the scrotum. Elevation of the testicle aggravates the pain (Prehn's sign) instead of alleviating it as it does in orchitis and epididymitis. The temperature may go up to 100°F. The testicle feels tense and the epididymis cannot be distinctly differentiated from the testicle by palpation. The determination of the position of the epididymis is of doubtful value except when it is not in its normal position of posterior and medial to the testicle. When the epididymis is normal in its relationships, it must be remembered that the testicle may have rotated 360 degrees or a multiple of it. Ownby and Atkinson[17] quote Dillon's sign. There is edema of the scrotal skin which extends up to the site of torsion and ends abruptly at this point. The scrotal skin is firmly attached and adherent to the underlying scrotal contents.

Differential Diagnosis. If the condition is kept in mind, torsion of the spermatic cord will be recognized more frequently. It must, however, be differentiated from other conditions which it may simulate: *Acute epididymitis:* This condition is slow in onset and runs a higher temperature. Leukocytosis is present, the epididymis is swollen, there is a urethral discharge and raising the testicle in the scrotum gives some relief. *Orchitis:* The onset is slow, the temperature is higher, the pain is less, the swelling is greater and the leukocyte count is higher. Prehn's sign is negative. *Traumatic hematocele:* The testicle is low in the scrotum, the condition is brought on by direct injury and there is ecchymosis of the scrotal skin. *Hydrocele:* The testicle is low in the scrotum, the swelling is greater, there is no pain and the condition is chronic. *Strangulated hernia:* There is a history of a hernia and vomiting is constant and progressive. Since both of these conditions require urgent surgery, the differential diagnosis between them is of academic interest only. The intra-abdominal testicle must be differentiated from such conditions as intestinal obstruction, ureteral spasm or calculi, etc.

Prognosis. The prognosis for life in this condition is good. There have been no reported deaths. The prognosis for the testicle is poor in all untreated cases. As mentioned above, there is a certain amount of vascular thrombosis with a concurrent loss of testicular tissue which occurs with each attack of torsion. The fact that detorsion is done manually or occurs spontaneously does not remove the predisposing cause of the condition nor does it relieve the prediliction to another attack in the future. Eighty per cent of cases of torsion of the testicle are "acute twisters" which will become gangrenous unless recognized and treated immediately. The remaining 20 per cent are the "recurrent twisters" which will become atrophied with fibrous tissue replacement if something is not done. According to Kreutzman and Strauss[8] the greatest amount of good can be accomplished in the latter group. However, because of the fact that in this group the pain is not too severe and clears up spontaneously, they are reluctant to submit to operation.

TREATMENT

Torsion of the spermatic cord is a surgical emergency. The treatment is predicated upon the principal that the obstruction to the blood supply must be undone before irreparable damage has occurred and that the prediliction for

recurrence must be removed. It must be kept in mind that torsion does not take place in the normal testicle and therefore the relief of the twist solves the problem for the moment only. Some provision must be made to prevent a recurrence with a possible loss of the organ. The various forms of treatment are:

Manual Detorsion. This is best done in the knee chest position. The maneuver can be successfully accomplished in some cases, but since it does not prevent recurrence, Hoffman and Ewert[19] and Wolf[15] believe that this form of treatment should be considered for its historical interest only.

Open Operation. It is the general concensus of opinion that open operation is the procedure of choice. The advantages are that the cord can be exposed, the amount and direction of the twist determined, detorsion may be done under direct vision, the condition of the testicle may be seen and the postoperative adhesions will help fix the testicle so that no recurrence will take place. The great majority of authors approached the testicle through the scrotum and then performed either an orchidectomy or an orchidopexy depending upon the findings at operation.

Orchidectomy. This procedure is done only after all attempts to revive the testicle have failed. This is especially important if the opposite testicle is undescended or atrophied. Untwisting the cord and relieving the pressure on the cord and testicle which has been produced by the edema are the most essential steps. Wrapping the testicle in warm, moist laparotomy pads is of some value. Any injury to blood vessels can be expected to produce reflex vasospasm. It has been demonstrated both clinically and experimentally by Herrlin, Glasser and Lange[21] that the injection of procaine hydrochloride into the mesentery of the small intestine relieves this spasm by inhibiting the autonomic impulses. If the viability of the organ is questionable, it might be wise to follow the suggestion of Dr. Herbert C. Chase who advocates the inhalation of pure oxygen while observing the organ in question for a change in color. Finally the use of fluorescein to determine the circulatory adequacy of the testicle should be employed. If it is necessary to remove the testicle, the use of a prosthesis to improve the cosmetic effect should be considered.

Orchidopexy. If the blood supply to the testicle is adequate, an orchidopexy of some type should be done to prevent recurrence. Wolf[15] advises fixing the testicle to the scrotum with two or three widely spaced sutures. Kreutzman and Strauss[8] suture the globus minor to the lower pole of the testicle and the globus major to the spermatic cord. The cord is then approximated to the fascia near the external inguinal ring. They do not believe that the testicle should be fixed to the scrotum because it loses its normal mobility. The author is in agreement with Ormond[6] and Ewert and Hoffman[19] that the contralateral testicle should be explored and an orchidopexy done to prevent possible torsion of the other side.

CASE REPORT

H. V. A twenty year old Puerto Rican male, was in the act of placing one table upside down upon another table while at work on April 10, 1946, when he was seized with a sharp, severe pain in the right scrotum. Dr. S. S. Geller, who saw him first, made the diagnosis of torsion of the right spermatic cord and referred him for surgery. The patient was seen by me two hours after his accident complaining of severe pain in the right testicle. He walked slowly and with his legs held apart. He sat down gently and rested his weight on his left buttock. Upon being examined in the supine position, he kept both knees drawn up. The right testicle was about one and one-half times its normal size, tense, extremely tender to touch and located high in the scrotum. The spermatic cord was thickened and tender. The scrotal skin was moderately "orange peeled" suggesting early edema. The testicle was in an

almost horizontal position, mobile and the pain was aggravated by raising it. The epididymis could not be palpated. There was no cough impulse and no history of a hernia. The left scrotal sac was small and atrophic. The left testicle was small, measuring 1.2 by 0.8 cm., very hard, nodular and insensitive to pressure. There was no nausea or vomiting. The abdomen was soft with no areas of tenderness and no palpable organs or masses.

The patient was hospitalized and the urinalysis was negative except for occasional spermatazoa seen in the sediment. The blood count was essentially normal with a white cell count of 9,400 of which 60 per cent were polymorphonucleated cells. The temperature was 98.6°F. At operation under spinal anesthesia an incision was made over the right inguinal canal parallel to the right inguinal ligament. The aponeurosis of the external oblique muscle was split, unroofing the inguinal canal. The spermatic cord was seen to be twisted on its long axis 180 degrees clockwise. The veins distal to the twist were markedly engorged and the spermatic cord was cyanotic. The testicle was displaced from the scrotum and found to be engorged, cyanotic, tense and swollen. An attempt was made to untwist the cord but this could not be accomplished. The three layers of the spermatic fascia were split from the internal inguinal ring to the testicle. The tunica vaginalis was opened wide and about 4 ounces of clear, lemon-yellow colored fluid escaped (this was sterile on culture). As soon as the cremasteric fascia had been incised the cord untwisted easily and the color returned to the testicle and cord. Two sutures were used to anchor the testicle in the scrotum so that it could not twist again. The gubernaculum testis was seen to be unusually long. All bleeding points were tied with two pound cotton ligatures. The fascia of the external oblique was closed with interrupted three pound cotton sutures and the skin approximated with interrupted four pound cotton sutures. (The cotton sutures are classified according to their tensile strength.) A scrotal suspensory was placed on the patient and he was returned to his bed in good condition. The following day the testicle and cord were nontender and the patient walked on the fifth day. Upon discharge from the hospital the testicle was slightly softer and smaller than normal. To this date, two months later, the testicle has shown no evidence of atrophy.

COMMENT

The gubernaculum testis was about three quarters of an inch long and is believed to be the predisposing factor in this case. In view of the accepted theory that the exciting cause of the actual torsion is a spasm of the cremaster muscle, it seemed logical to split this muscle from the internal ring to the testicle. This should serve a threefold purpose: (1) It should relieve all pressure on the dangerously edematous and engorged spermatic cord and its vascular channels by opening the envelope which contains them; (2) it makes untwisting of the cord more simple and (3) it should prevent recurrence because of the postoperative adhesions which will form. It is easier to do this by unroofing the inguinal canal than by a scrotal approach. The tunica vaginalis should be opened and left open in order to relieve the pressure on the testicle and thus aid in maintaining its viability. The procedure of everting the tunica vaginalis adds additional trauma to an already precarious condition.

This patient spoke no English and so it was difficult to obtain an accurate history but even with the aid of an interpreter, no history of injury or attack of pain in the left testicle could be elicited. He denied having had mumps. In fact the patient was not aware that the left testicle was abnormal. Inasmuch as this testicle was small, hard, fibrous and nodular and the patient denied having had mumps or having suffered any trauma to it, it is not at all improbable that he had had an attack of torsion of the left spermatic cord in the past with a resultant atrophy of the testicle. Since the diagnosis of torsion of the left spermatic cord would have to be based upon circumstantial evidence, this case is not being reported as bilateral torsion of the spermatic cord.

SUMMARY AND CONCLUSIONS

1. Torsion of the spermatic cord is more frequent than is generally supposed.

2. The causes and types of torsion are enumerated.

3. All cases of torsion merit an orchidopexy to avert a future testicular tragedy.

4. Attention is drawn to the possible occurrence of torsion in the contralateral testicle.

5. A procedure has been suggested to determine the adequacy of the blood supply to the testicle.

6. Another operative approach has been suggested.

7. A case of torsion of the spermatic cord is reported.

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INCARCERATION OF THE STOMACH IN AN UMBILICAL HERNIA

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THE following case report illustrates the extreme emaciation that may result from a mechanical obstruction of the stomach when incarcerated in a large umbilical hernia.

A B C

FIG. 1. A, photograph of patient when she weighed 285 pounds; B, appearance of patient when she weighed 95 pounds; C, photograph taken four years after operation; weight 243 pounds.

CASE REPORT

A female patient, aged forty-nine, was admitted to the University of Kansas Hospitals, November 9, 1941, complaining of a rupture. She stated that the rupture first appeared twenty-two years ago soon after an accident in which a cow stepped on her abdomen. The hernia did not increase in size very rapidly until after the birth of her two children five and eight years following the accident. Two years before admission to the hospital the hernia had grown very large and she began to have attacks of vomiting. At times she would vomit large quantities of undigested food. The vomiting attacks were not accompanied by pain. For two years the vomiting continued at irregular intervals. Constipation was persistent for one year during which time she had but three spontaneous bowel movements. She had taken many different kinds of laxatives without much benefit and finally enemas were necessary to empty the colon. Her weight two years before entering the hospital was 285 pounds. There was a gradual loss of weight for two years and when she entered the hospital, her weight was 95 pounds. (Fig. 1.)

The most striking features of the examination were the extreme emaciation and a large pendulous pedunculated ventral hernia which hung below the pubes. It measured approximately 25 by 30 by 35 cm.

X-ray studies with barium in the stomach

showed more than one-half of the stomach in the hernial sac. (Fig. 2.) With a barium enema the cecum, ascending and transverse colons could be demonstrated in the sac.

Laboratory examinations were normal except a vitamin C deficiency. The total serum protein was 6.8 Gm.

At operation an elliptical incision was made about the pedicle of the hernia extending from one flank to the other. The elongated stomach and gastrocolic mesentery were found adherent to the anterior wall of the hernial sac. The cecum, ascending colon, transverse colon and descending colon were in the sac. The mesentery of the colon was long and the hepatic and splenic flexures could not be identified. The sac was removed and the hernia was closed with silk by the Mayo method.

Recovery from the operation was uneventful. Increase in weight began soon after the patient was discharged from the hospital. In September, 1945, four years after the operation, the patient reported her weight as 243 pounds. There have been no stomach or bowel disturbances since the operation.

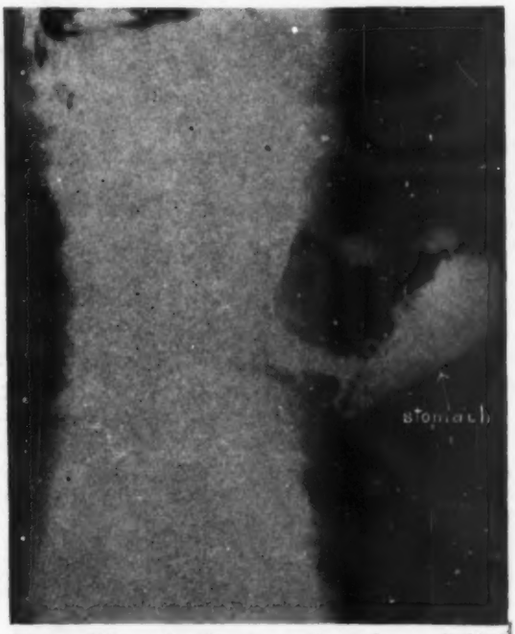

FIG. 2. *X*-ray showing approximately one-half of stomach in hernial sac.

ACUTE TRAUMATIC ANEURYSM OF THE PALM

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THE purpose of this paper is to add a case of true acute traumatic aneurysm of the palm to the literature. This lesion is relatively rare; only one case was seen in a large overseas General Hospital in forty-four months. Zuckerman and Proctor[1] recently published an excellent review of the literature on this subject and added one case to the literature.

FIG. 1. Anterior view showing removal of aneurysm.

CASE REPORT

H. W., a twenty-one year old white soldier struck the handle of a screw driver with the left palm while attempting to open a case. Following the injury, the palm became tender and one week later he noticed a lump at the site of the injury. He was seen at sick call and the diagnosis of contusion was made. A splint was applied and the patient was placed on quarters status. One week later, the splint was removed and the patient was returned to duty. The patient was again seen nine weeks later at which time an aspirating needle was inserted into the lump and bright red blood was obtained. The patient was then sent to the hospital.

Examination on April 9, 1945, showed a well nourished white male whose only obvious abnormality was a pulsating tumor occupying the medial aspect of the left palm about one-half the distance between the wrist and the proximal flexion crease of the palm. There was no evidence of a skin lesion in this area. The tumor measured 2.5 cm. in diameter. There was no bruit or thrill. The mass could be compressed and partially emptied with some difficulty. Occlusion of the radial pulse did not change the pulsation. Occlusion of the ulnar artery stopped the pulsations. Blood pressure of the left arm was 120/78 and of the right arm 110/80. A diagnosis of traumatic aneurysm of the ulnar branch of the superficial palmar arch was made and this diagnosis was confirmed by an arteriogram.

Under sodium pentothal anesthesia, a short incision was made just lateral to the hypethenar eminence of the left palm. When the palmar fascia was incised, a mass about 1 cm. in diameter was identified (Fig. 1) attached at the proximal and distal ends by a normal appearing ulnar artery. The tourniquet was released long enough to identify the mass definitely as the pulsating tumor. The artery was then ligated proximally and distally to the tumor and it was removed.

The wound healed per primam. The patient was discharged from the hospital to duty on the ninth postoperative day and was subsequently seen one and two months following his discharge, at which times his hand was asymptomatic and he was performing his regular duties.

The pathologist's report was as follows: "Gross: specimen consists of an arterial segment, the central portion of which is greatly dilated and measures 1.2 cm. in diameter. Microscopic section reveals a roughened intima

with evidence of hyaline degeneration and edema of the muscularis. Diagnosis: Aneurysm. —Arterial."

SUMMARY

A case of acute traumatic aneurysm of the palm is presented with clinical and operative findings. Postoperative observation of two months showed complete return of normal function.

REFERENCE

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Thrombophlebitis of the veins in the pelvis is treated in the same manner as that for parametritis. The two conditions often occur together, and thrombophlebitis of the femoral vein may be merely an extension from higher up.

From "The Management of Obstetric Difficulties" by Paul Titus (C. V. Mosby Company).

UTERUS DIDELPHYS WITH ECTOPIC TUBAL GESTATION

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AND
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WHILE instances of uterus didelphys, particularly when associated with ectopic tubal gestation, are not common, the general anatomical findings of the condition are familiar. However, no reference has been found in the literature relative to a peritoneal septum in the pelvis such as has been observed in the patient being reported. It is possible that the pelvic septum represents a further and adventitious anomaly. On the other hand, very few patients having uterus didelphys have been examined in the absence of gross anatomical distortion due to pregnancy, consequently the presence of such a septum may have been overlooked. A brief résumé of the clinical and anatomical findings in this patient follow:

CASE REPORT

A twenty-five year old, white female, former army nurse, married five months, had always had normal menstrual periods. Her last menstrual period was February 20, 1946. On March 30, 1946, she began having slight painless vaginal bleeding. On April 2nd, she devleoped stabbing pains in the right lower quadrant and was treated by a local doctor. The following day three large, dark clots of blood which contained no fetal or placental tissue were passed from the vagina. On April 5th, similar vaginal bleeding recurred and she was admitted to the local hospital where ergotrate was administered intramuscularly. The ergotrate was discontinued on April 7th, when she developed severe cramping pains in the right lower quadrant. On April 9th, the patient was discharged from the hospital. She had no abdominal pain but still noted a slight amount of dark vaginal bleeding occasionally. This type of vaginal bleeding continued intermittently until the night of April 17th, when moderate, constant pain developed in the right lower quadrant and the patient was brought to this hospital.

On examination at this hospital her temperature was 101°F., blood pressure 94/56 and pulse 112. She appeared sallow but was alert and did not manifest any other symptoms of shock. Pelvic examination revealed a double uterus and complete septate vagina with the cervices partially fused in the midline for a distance of 2 centimeters at their lower most ends. There was a tender mass indistinguishable from the right uterus about the size of a two months' pregnancy. The left uterus was normal in size and consistency and was not tender. No adnexal masses were palpated. Blood studies revealed the hemoglobin to be 80 per cent. The red blood cell count was 3,700,000 and the white blood cell count 8,500. The differential blood count showed 78 per cent polymorphonuclear leukocytes and 22 per cent lymphocytes. The urinalysis was negative. The admitting officer considered the patient to have an incomplete abortion possibly with infection present. The patient was treated with 30,000 units of penicillin intramuscularly every three hours.

During the early morning of April 18th, the pain in the right lower quadrant became more severe and was accompanied by marked urinary urgency. Pelvic examination revealed a mass in the right lower quadrant which extended upward to within 2 cm. of the right anterior superior iliac spine and medially just to the right of the midline. The mass was exquisitely tender and there was marked rebound tenderness over the entire lower abdomen. A diagnosis of ruptured, ectopic, right, tubal gestation was made and an emergency laparotomy was performed.

The abdomen was opened through a low midline incision. On opening the peritoneal cavity a large quantity of dark blood was encountered. This was aspirated and the intestine packed off. There was a large mass in the right adnexa composed of the right Fallopian tube,

right ovary and massive blood clots. The blood clots were extracted. An examination of the right adnexa revealed that the ectopic pregnancy had implanted itself in the right Fallopian tube and had recently ruptured the tube. The right ovarian vessels were doubly clamped and ligated. The right mesosalpinx was clamped and ligated. The intramural portion of the right Fallopian tube was excised from the cornu of the right uterus. The defect in the cornu of the uterus was repaired by interrupted chromic catgut sutures. The right round ligament was grasped a short distance from its attachment to the cornu of the right uterus, brought behind the uterus and sutured there with interrupted chromic catgut sutures. This structure was utilized for giving support to the right uterus and for covering all raw surfaces at the cornu of the right uterus. All bleeding was under control at the completion of this stage of the operation. The blood clots which were accessible were removed and all blood aspirated from the abdominal cavity.

Exploration of the pelvis revealed that two uteri were present. The uterus in the left side of the pelvis was about normal in size, while the one in the right side of the pelvis was slightly larger. Separating the two organs was a septum, composed of two layers of peritoneum enclosing a sheet of areolar tissue, which divided the pelvis sagittally into two halves. This septum of tissue was continuous with the mesentery of the sigmoid colon and extended from this structure and the rectum anteriorly to the bladder and the region of the space of Retzius. However, the ventral margin of the pelvic septum had no attachments in the sagittal plane with the perietal peritoneum of the anterior abdominal wall except in the region immediately ventral to the bladder. One round ligament, one Fallopian tube and one ovary were present on the left side of the left uterus and the right side of the right uterus, respectively. After completing the exploration the abdominal wound was closed in layers. The patient had an uneventful convalescence.

COMMENTS

A possible embryological explanation of the pelvic septum discovered in this patient is offered. After the cloaca has divided into the urogenital sinus and rectum, the Müllerian ducts join the former. They come to lie side by side and then fuse, effectively intervening between the two derivatives of the cloaca. In uterus didelphys, the two Müllerian ducts are in apposition only at their most caudal end and never intervene between the intraperitoneal bladder and rectum.

As growth progresses, the bladder migrates ventrally and the rectum dorsally relative to the uterus, and the peritoneum is applied to them, forming the vesciouterine and recto-uterine pouches. If the peritoneum does not fill the pelvis prior to the fusion of the Müllerian ducts, it must be drawn down to the region of the cervix, near the anterior and posterior fornices. In uterus didelphys, a tropic effect such as this may be missing in the midline only. A sling of peritoneum may be left between the bladder and rectum, elongating in the sagittal plane as they the separate. At the same time, the peritoneum may apply itself to the region of the cervices except where they are joined. According to this hypothesis two soft tissue pelvic fossae would be formed, divided by a septum which contains nothing but areolar tissue. This in effect is what was found in the pelvis of the patient discussed.

The anatomy of the pelvis and vagina in this patient offer several interesting clinical problems. When uterus didelphys is present, colpotomy should be done in a lateral direction. Furthermore, if this procedure is performed for diagnostic purposes, it should be carried out bilaterally. It is possible that in order for the patient to be delivered through the vagina a plastic procedure may have to be performed upon the double vagina. If this is necessary but is not done, the patient could be delivered by means of cesarean section.

It is possible that a subtotal hysterectomy should have been performed upon the right uterus. Subtotal abdominal hysterectomy is suggested because of the partial fusion of the two cervices at their lower most ends. In addition to the technical difficulties

offered by the anomaly, the removal of the right cervix may result in sufficient scarring and distortion of the remaining cervix to interfere with subsequent normal delivery. However, there was no evidence that both uteri had not menstruated at the same time. Furthermore, it was believed that the patient's condition, while satisfactory, did not justify a more extensive procedure than that which was done.

There was no evidence that the patient could not become pregnant in the left uterus. The left tube and ovary, as well as the uterus, appeared normal in all respects. If the sagittal pelvic septum dividing the pelvis into two halves interferes with the proper enlargement of the uterus or interferes with the pregnant uterus lifting itself out of the pelvis, this septum will have to be removed by an abdominal operation at some future date. If the two uteri menstruate alternately and in addition to the resulting inconvenience are responsible for the patient developing a secondary anemia, a hysterectomy on the right side can be performed. This procedure could be combined with a plastic operation upon the peritoneal septum in the pelvis already described.

As stated previously, the operation performed for ectopic tubal gestation was considered a life saving procedure. It was felt that any plastic procedure should be deferred until some future date when the patient is in excellent condition and circumstances have been clarified as to what plastic operation should be performed so as to place the patient in a more normal and healthy state.

SUMMARY

1. Uterus didelphys, particularly when associated with ectopic gestation, is an uncommon condition. A patient in which this situation existed has been reported.

2. In addition to uterus didelphys, a pelvic septum, which divided the pelvis sagittally into two halves was found in the patient reported. A possible explanation of the embryological development of this structure has been offered.

3. Some of the anatomical and clinical problems associated with uterus didelphys have been discussed.

New Instruments

NEW PRINCIPLE IN MECHANICAL ABDOMINAL RETRACTION*

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IT is almost trite to say that good exposure is the *sine qua non* of efficient abdominal surgery. In war surgery when the routine incision for abdominal exploration often extended from ensiform to pubis, exposure was seldom a problem which, incidentally, was probably an important factor in the excellent results obtained in our overseas hospitals. In civilian practice, however, cosmetic as well as other considerations necessitate a much smaller incision. The problem of exposure then narrows down essentially to the problem of good retraction. Expecially is this problem of adequate retraction of importance in the smaller hospitals which in the aggregate serve a large proportion of our population.

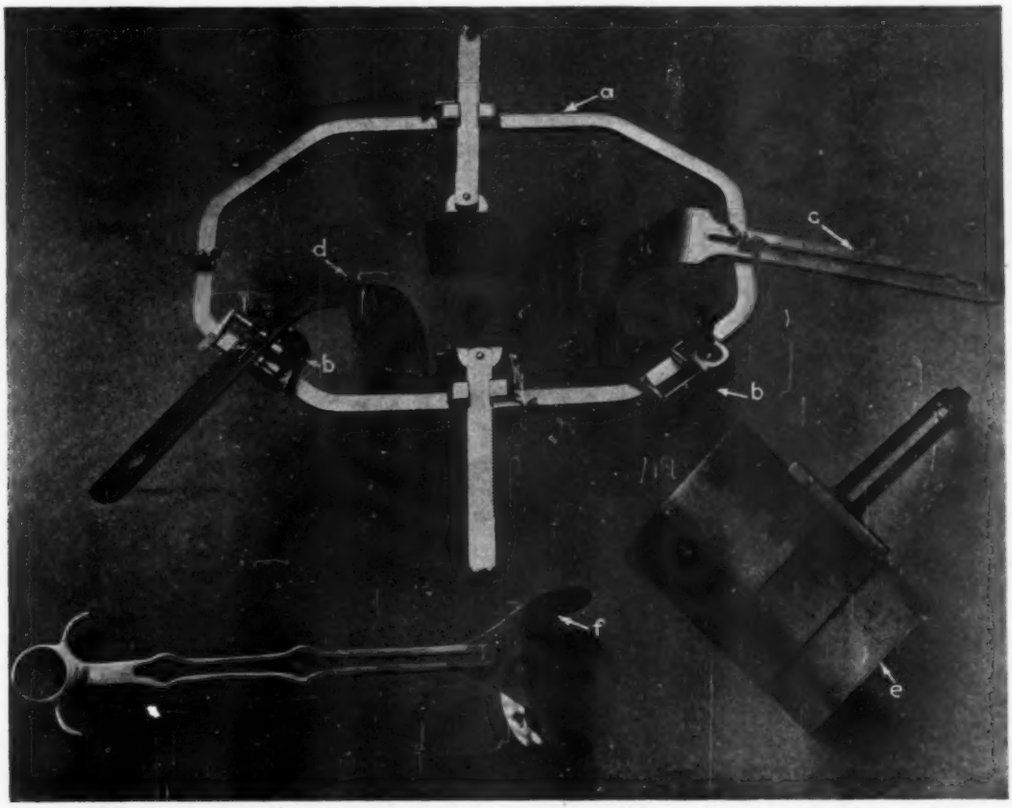

FIG. 1. The retractor and its component parts. *a*, Octagonal frame; *b*, universal joint and clamp; *c* and *d*, blades fixed respectively to the frame and universal joint; *e*, expanding blade; *f*, standard bladder retractor blade.

In the larger medical centers enough residents or internes are usually available

* Manufactured by Edward Weck & Co.

so that in a major operation retractors may be held by hand. However, certain factors mitigate against the efficiency or even the desirability of hand retraction. The first assistant must not be distracted by the necessity of occasionally holding a retractor or replacing retractors held by a tiring second assistant. In work of major scope three assistants are often used; here the work is just as apt as not to be impeded by the crowding around the table. The very human element of fatigue on the part of the retractor holders is prone to become a problem in precisely the places where steady and adequate retraction is most important in long drawn out deep abdominal procedures. From the point of view of the downtrodden retractor pullers, no less than that of the operator, a device which would render hours of physical effort unnecessary while maintaining the adequacy of the exposure would be a priceless gift. Hence, even in our largest medical centers with their plethora of assistants mechanical retraction which could accomplish what hand retraction does would be a definite boon.

In the smaller community hospitals no profusion of assistants is ordinarily available. Here the problem of adequate retrac-

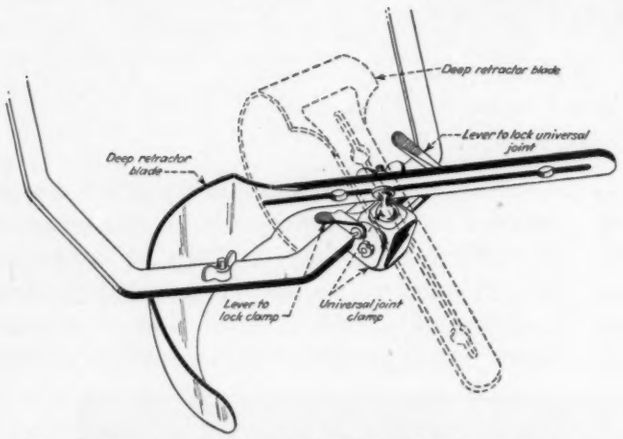

Fig. 2. Showing the angulation and mobility available by use of the universal joint.

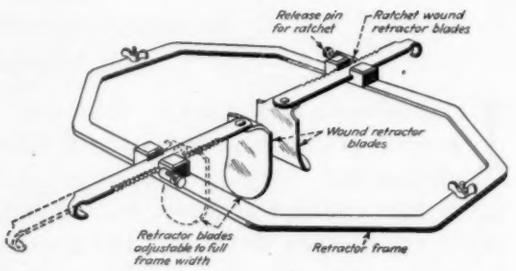
Release pin for ratchet
Ratchet wound retractor blades
Wound retractor blades
Retractor blades adjustable to full frame width
Retractor frame

Fig. 3. Illustrating ease of width adjustment of incision.

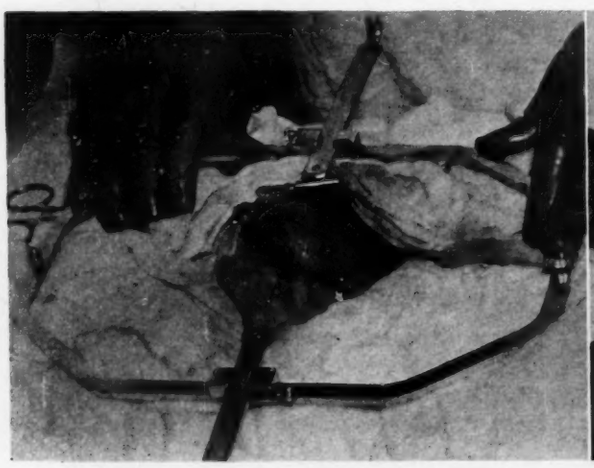

Fig. 4. Retractor without accessory blades at start of cholecystectomy.

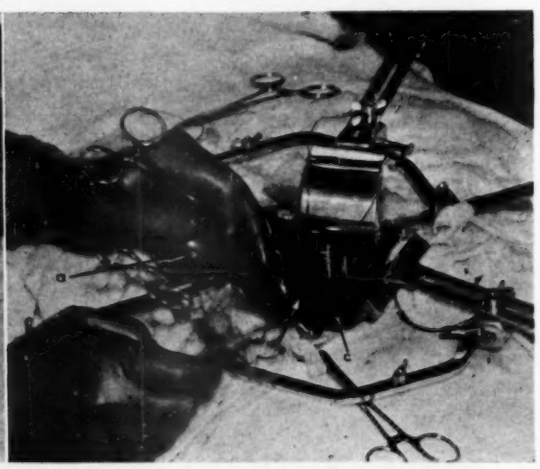

Fig. 5. Retractor in cholecystectomy showing cleanly walled-off field of operation. Note clearly defined anatomical landmarks: *a*, gallbladder; *b*, ligature on cystic duct; *c*, common duct.

tion has customarily been solved by the use of the available self-retaining retractors. The deficiencies of these retractors are too well known to require extended comment.

Having worked in a smaller suburban hospital for a number of years under these handicaps, it occurred to the writer that two essential elements were missing in any of the then available self-retaining retractors. The first was that in any of the existing instruments the retraction could not always be made to work precisely where the operator intended it to. This was due to the fact that although the handle could usually be slid along the frame, the blade being fixed to the handle at a constant angle, always exerted its restraining effect in a plane roughly perpendicular to the handle (and hence, to the anterior abdominal wall.) Retraction is frequently needed, however, at a point so deeply placed, and so far laterally beneath the incision that no standard blade can reach it; to do so, the retractor would need an awkward, long blade fixed at an acute angle to the handle.

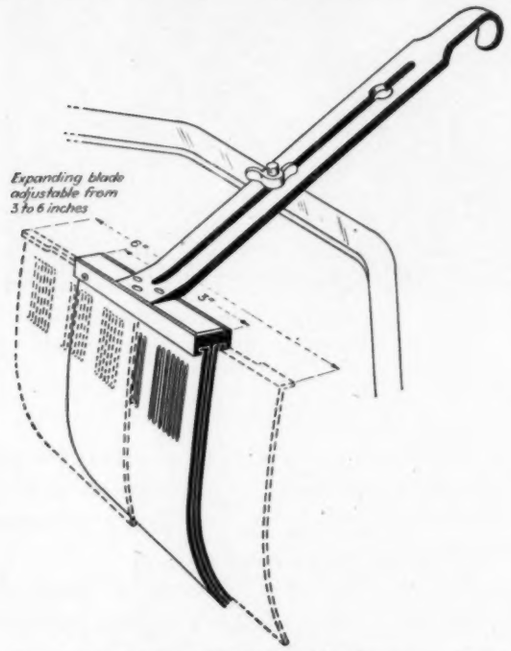

Fig. 6. Variable width blade showing normal and expanded positions.

This feature was solved by the use of a universal joint which can be attached anywhere along the circumference of an octagonal frame. Any slotted standard retractor can be attached to this joint and by tilting the handle upward the point of the blade can be made to reach deep underneath and laterally to the incision. The universal joint can be firmly locked at any point on the frame and the retractor having been placed at any desired angle securely locked at the joint (Figs. 1 and 2.) Figure 1*b* shows the two universal joints in place on the octagonal frame *a*. The ratchet arrangement on the octagonal frame enables the wound to be opened and secured at any desired width. (Figs. 3 and 4.) Also shown in Figure 1 are a slotted malleable retractor *c* which has been found very useful, a slightly modified Deaver (with slotted handle) *d* and a standard bladder retractor *f*. Any of these may be attached either directly to the frame (as in *c*) or to the universal joint (as in *d*). The standard Horgan, Bland or Balfour blades may be used on the instrument without modification.

Figures 4 and 5 show the retractor being used in a cholecystectomy; in Figures 7 and 8 its use in a pelvic laparotomy is illustrated.

The second element in which standard mechanical retractors were found to be deficient was that no blade was wide enough to wall off adequately the constantly shifting intestines and keep them away from the field of operation. Six inches was found by experiment to be the optimal width for retraction of this type but a six-inch blade would be totally unwieldy. This difficulty was overcome by construction of a new type of blade of standard width which could by a simple movement be expanded to any desired width up to 6 inches. (Figs. 1*e* and 6.) The angle of the blade to the handle was designed specifically to make the blade lie parallel to the superior border of the sacral promontory, so that in a pelvic laparotomy with the handle lying flat on the abdomen, the expanding blade covering a

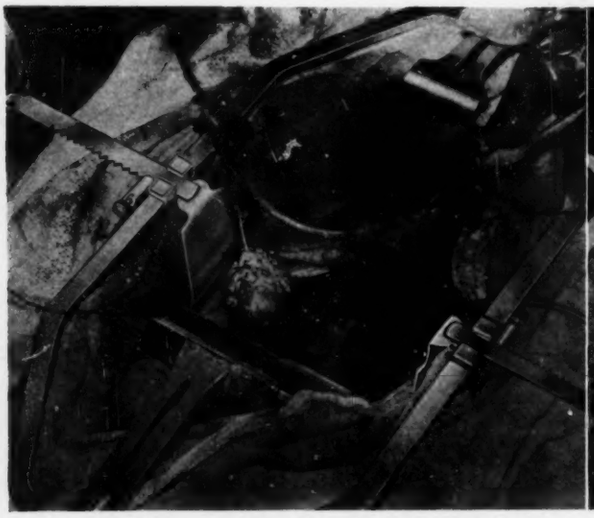

FIG. 7. Retractor in pelvic laparotomy showing excellent exposure and use of expanding blade.

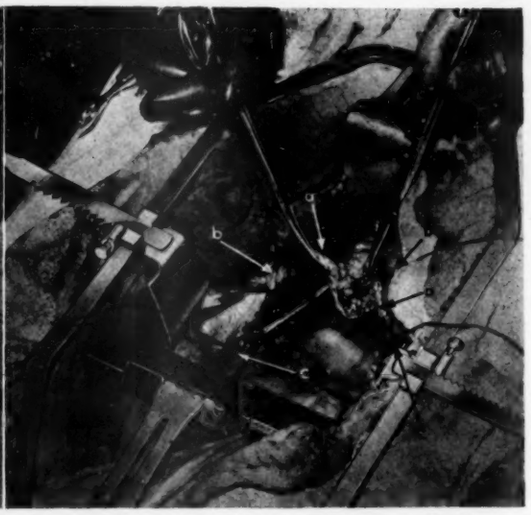

FIG. 8. Retractor in hysterectomy showing ease of exposure. *a*, uterine vessels; *b*, round ligaments; *c*, ovarian vessels.

lap pad very effectively seals off the intestines. This is clearly shown in Figures 7 and 8. This blade was found to be most useful in other procedures of abdominal surgery besides pelvic laparotomies; held by hand it furnishes adequate retraction when working in the lateral gutters where mechanical retraction with any instrument has been found to be inadequate. It is also very useful in gallbladder surgery (Fig. 5) as well as lower abdominal procedures such as abdominoperineal resection.

The two outstanding deficiencies of available self-retaining retractors—the inability to place the retractor blade at the desired angle or depth and the lack of width of the retractor blade itself—have been completely corrected by the use of the two new principles herein described, the use of the universal joint and the expanding retractor.

SUMMARY

A self-retaining abdominal retractor embodying two entirely new mechanical principles is described. The retractor possesses the following advantages:

1. By means of a universal joint the blades can be held securely at any position, angle or depth desired.
2. An expanding blade provides efficient visceral retraction to a width of 6 inches.
3. A malleable retractor and a Deaver blade slightly modified may be used as an integral part of the instrument.
4. The standard slotted blades of existing self-retaining retractors may be used interchangeably with the instrument.

Many thanks are due Dr. Sol Shlimbaum for his suggestions as well as Drs. Charles C. Murphy, Earl B. McCoy and Fred Bromberg for their cooperation during the development of this instrument. Thanks are due also to Dr. Anthony Kohn, the author's associate, for help in the preparation of this article.

BIOPSY DRILL PUNCH*

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ALTHOUGH in modern practice the removal of tissue from suspected cancerous lesions for biopsy is no longer regarded as hazardous, nevertheless the removal of a specimen from a firm or dense tumor, especially when it is covered by intact mucous membrane, may traumatize the growth and be painful for the patient when performed with conventional instruments, the most widely used at the present time being some form of biting forceps.

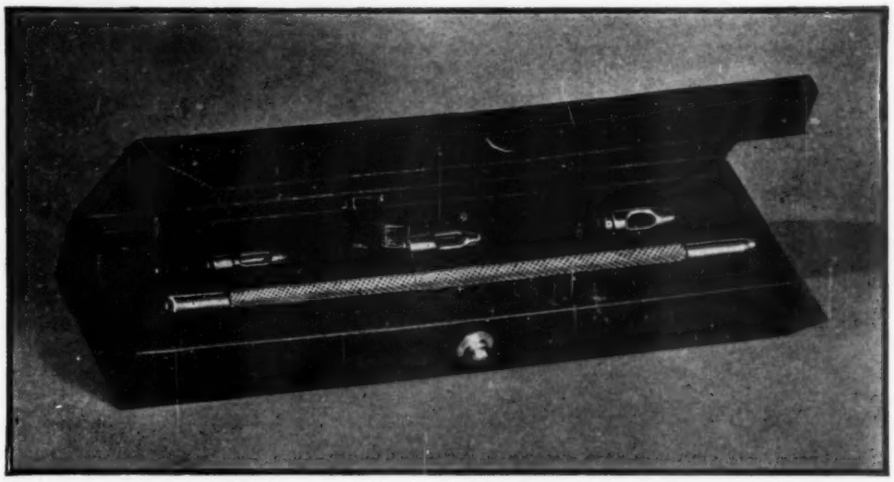


FIG. 1. Biopsy drill punch. Instrument has a single handle to which one of nine variable sized circular sharp punches may be attached (1½ to 12 mm.). It cuts cleanly and cores out a tissue specimen of the desired size.

The instrument† which is shown in the accompanying diagram (Fig. 1) consists of a series of variously sized, sharp, circular, detachable punches resembling the ordinary leather punch. The desired size of punch is attached to the handle and after the selected area for biopsy has been infiltrated with an anesthetic solution, the instrument is applied to the tissue and rotated back and forth several times until it has penetrated to a depth of 5 to 6 mm., thus freeing the specimen from all surrounding attachments except at the base. Laying aside the punch, the specimen is removed by grasping it with forceps and severing the base with a pointed scalpel or biting forceps. The device is of particular value in performing biopsies of non-ulcerated, non-friable tumors in the oral cavity and pharyngeal wall (Fig. 2) in addition to tumors in other accessible areas of the body.

The instrument has a single handle to which one of nine tips may be attached. The available tip sizes are 1½, 3, 4½, 5, 7, 8, 9, 11 and 12 mm. in diameter.

SKIN GRAFT DRILL PUNCH

This instrument has been designed to facilitate removal of skin lesions, thereby securing a circular wound with smooth even borders which may be closed from

* From the Head and Neck Service, Memorial Hospital, New York.
† This instrument is manufactured by and may be purchased from the United Surgical Supplies Co., New York, N. Y.

side-to-side with interrupted stitches. In addition to enabling the operator to core out a skin lesion, the same instrument may be employed if desired to obtain a full thickness skin graft from another part of the body to cover the resultant defect.

The device consists of a special handle with a countertension ring which holds the tissue firmly in place while coring and with five sizes of circular coring tips which measure 7, 10, 12, 15, and 17 mm. in diameter. (Fig. 3.)

Fig. 2. Photograph of a suspected cancer of the tongue, illustrating use of the drill punch in obtaining a tissue specimen for biopsy. The instrument has been placed in the desired area (local anesthesia) and is rotated back and forth several times for a depth of 5 to 6 mm. The specimen is removed by severing the attached base with a pointed scalpel or biting forceps.

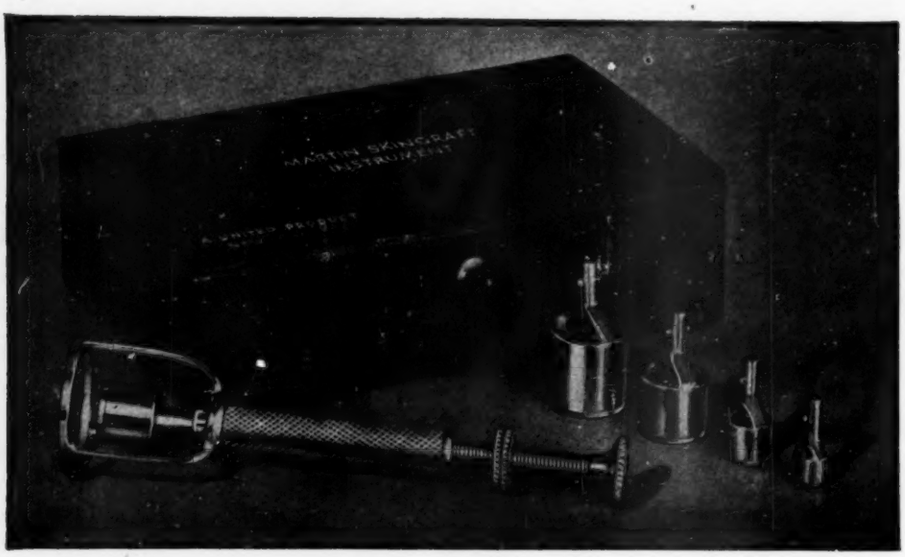


Fig. 3. Skin graft drill punch. An instrument which enables the operator to perform a clean circular excision of a skin lesion. If the defect is to be covered with a full thickness skin graft, the same instrument may be used to core out a graft from another part of the body. The device consists of a special handle with a countertension ring (holds tissue firmly in place while coring) and five sizes of coring tips, measuring 7, 10, 12, 15 and 17 mm. in diameter.

Bookshelf Browsing

FOUR PIONEER ARCHITECTS IN BONE

KNIGHT, TAYLOR, SAYRE AND DAVIS

EDWARD PODOLSKY, M.D.
BROOKLYN, NEW YORK

FOR the most part the trail in modern bone surgery was blazed by four men: James Knight, Charles Fayette Taylor, Lewis A. Sayre and Henry G. Davis.

Dr. James Knight became interested in bone surgery when he had succeeded in inventing a truss for the treatment of hernia. This he stated, "served as an incentive to the construction of appliances for the rest oration of impaired powers of locomotion in children, laboring under deformities, both congenital and the sequelae of infantile paralysis. Other deformities resulting from constitutional impairment led to a careful study of pathological conditions, such as caries of the spine terminating in spinal or psoas abscess. These latter ailments were carefully considered and a careful regime with proper sanitary regulations and conditions were found the primary requisition of proper treatment. Such conditions, we concluded, were only attainable in the highest degree in a hospital of proper construction. With this impression we introduced the initiatory efforts in our own dwelling." This was in 1863 and from that time on the world began to realize the importance of proper hospital care in the treatment of bone and muscle diseases.

Dr. Knight's hospital was constructed in 1870 and he lived in it with his family and assistants, giving all his time to the treatment of bone disorders. The great majority of cases in those days was tuberculosis of the bones and these patients were required to remain in the hospital for months and even years at a time. "Physical training and instruction, both religious and secular, were part of the daily life of the patient. Bodily activity was enforced. No child able to hold up its head is ever kept in bed during the day, and all able to walk by pushing a chair before them have thus to exercise for a certain time, and those unable to walk from pain and tenderness are supplied with rolling chairs. Even the most vigorous and robust constitution would inevitably be weakened and brought to a state of etiolation by long continued repose, and in a weak constitution the malady would be proportionately increased."

Dr. Knight was essentially a conservative bone surgeon. He believed most heartily that "by properly enforced hygiene, by regular and nutritious dietary, by mechanical appliances to secure rest for an invaded joint but avoiding every grave surgical interference and by employing every means that contribute to the strength, vitality and comfort of the patient."

The chief claim of Dr. Knight to fame is that he founded the first great bone hospital in the world, The Hospital of New York City for the Relief of the Ruptured and Crippled. This institution has exerted a great deal of influence in the development of bone surgery in this country and throughout the world.

Dr. Henry G. Davis was a contemporary of Dr. Knight and he had similar ideas. He invented a spinal brace for the treatment of serious diseases of the spine; he also invented a hip splint which did away with unnecessary surgery in the treatment of affection of the hip joint. Dr. Davis's work

was little appreciated in his time and his life was one of disappointment at the lack of understanding of the need for his new ideas in bone surgery.

The third and greatest of the modern trail blazers in bone surgery was Dr. F. Fayette Taylor who did some notable pioneering in the treatment of tuberculosis of the bone. His interest in this disease was stimulated by his own experience in the treatment of Pott's disease by exercises designed to check the purposes of deformity of developing muscular resistance.

During the early years of his practice there came under his observation a case of tuberculosis of the spine which was to play a most important rôle in his life. The victim was a little girl. The mother was very insistent; she wanted to know just what the trouble was with her child. Dr. Taylor explained the ailment in a few brief sentences and tried to get away. But the mother was still anxious; she detained the doctor and asked for more information on the nature of the disease. Reluctantly Dr. Taylor explained that her little girl had incipient tuberculosis of the spine, which was at best a rather hopeless ailment.

"How can this be?" the mother persisted, "To all appearances my child is as well as any child. She is not, and she has not been sick as far as I know."

Dr. Taylor replied saying that in spite of her outward appearance she was suffering from a very serious bone disease. The mother listened and after a few minutes said somewhat hopefully: "Well, of course, it can be cured. It has been discovered so early."

Dr. Taylor believed in the policy of telling the truth, no matter how serious the disease. He replied that so far as he knew there was no cure for it.

The mother sat thoughtfully for a few minutes and then asked: "What am I to do?"

Again Dr. Taylor was faced with the unpleasant duty of telling her that as time went on the disease would become worse.

"How long will this be going on?" asked the distracted mother.

"For many years."

"And what will be the result?"

Dr. Taylor described the usual final stages of the disease.

"Do you mean to say," asked the mother, "that my little girl here, who has always been apparently a healthy child, now appears to be so, who is still plump and straight, must go down before my eyes, must suffer, may be confined to bed with paralysis, with discharging abscess through the years, becoming dwarfed and emaciated, distorted and disfigured, and there is nothing which can be done to prevent, or even mitigate such a terrible calamity?"

Dr. Taylor had to reply yes to all these questions. But the overpowering impression that this pitiful entreaty made on him remained for a long time. It made him resolve to attempt to find some means of even giving the slightest aid to this little girl.

After weeks of experimenting Dr. Taylor devised an appliance which he called the spinal assistant. This instrument is one of the greatest achievements of the modern bone surgeon. The spinal assistant is a type of support consisting of steel bars placed on either side of the diseased spine attached above and below to serve as a splint.

Like most great ideas this one came as an inspiration. This is how Dr. Taylor himself describes the incident: "The first real light broke in upon me when one evening just as I passed into the bright light pouring from an ice-cream saloon the thought of the principle of action of a special instrument that would have fixed points and afford perfect protection to the diseased vertebrae struck me. The sensation was most awful. I jumped as if I had received a physical blow, and ran all the way home. The next day I went down town and made the instrument." In this way the first great appliance for the treatment of spinal disease came into existence. Dr. Taylor thereafter devoted his life to the mechanical treatment of diseases of the bone and

attained a reputation as one of the foremost orthopedic surgeons of his time.

The fourth of the great pioneer bone surgeons was Dr. Lewis A. Sayre. He was a well known surgeon as early as 1853. He was one of the founders of Bellevue Medical School and its first professor of orthopedic surgery. Dr. Sayre had always been enchanted with the possibilities of bone surgery.

Dr. Sayre, like Dr. Taylor, had in early life an illuminating experience which was to exert a profound influence. While serving his apprenticeship he had a patient with an abscess about the knee which Dr. Sayre proceeded to open. When he reported the result to his superior the latter called him a "damned blockhead." He had specifically forbidden the opening of so-called cold abscesses about the knee.

"You've killed the man," the professor of surgery growled.

"But," says Dr. Sayre," he didn't die. He got well, and I never believed anything that any of them told me after that." He had learned to think for himself.

Dr. Sayre invented an operation for reconstructing the diseased hip and restoring it to usefulness. He also invented the plaster jacket for the treatment of certain types of bone deformities, as well as new instruments to make operations on the bone easier and simpler. When Dr. Sayre wrote his great book on bone surgery it was introduced by a quotation from the writings of Dr. Valentine Mott, one of the early great American surgeons. The quotation ran as follows: "It was my happy lot, even at my advancing time of life . . . . to witness, also, the dawning as well as the meridian splendor of another new and illustrious era in the healing art; I refer to that beautiful and exact science, *limitedly* denominated *orthopedic surgery*."

THE BROOKLYN ANATOMICAL AND SURGICAL SOCIETY*

RUSSELL STORY FOWLER, M.D.
BROOKLYN, NEW YORK

ON March 20, 1878, George Ryerson Fowler and Lewis Stephen Pilcher met with a small group to form The Brooklyn Anatomical and Surgical Club, whose object should be the promotion of the practical study of anatomy and surgery by the maintenance of rooms for the pursuit of such studies, by the formation of a museum, by the accumulation of a library, by lectures and demonstrations and by stated meetings for the discussion of subjects pertaining to that special field.

Lewis S. Pilcher was elected President, George R. Fowler secretary and Zachery T. Emery treasurer. Rooms were secured and fitted up for its use. On September 6, 1879, the Club was incorporated in accordance with the laws of the State of New York, as "The Brooklyn Anatomical and Surgical Society" and was privileged to have a School. The Medical School was incorporated October 17, 1879, so that a member could give instruction in the lecture rooms and laboratories of the Society to persons not members of the Society. Among those who lectured were such famous men as Frank H. Hamilton, Fessenden N. Otis, John C. Dalton, Albert H. Buck and John A. Wyeth. To those familiar with the history of Brooklyn and New York of those years these names will recall much.

It was my privilege as a child to have been taken by my father to the rooms of the Society. I well remember the impression made upon me, the lecture and demonstration room with a black table in the center and three rows of black benches around; the side rooms with shelves with specimens under the windows so that the light shown upon them. It was also my privilege to have known and to remember some of the original members, particularly Zachery T. Emery, later Health Officer of Brooklyn, Dr. Charles Jewett who brought me into the world and who became Professor of Obstetrics and Gynecology at Long Island College Hospital and Lewis S. Pilcher, first Editor of the Annals of Surgery and the longtime associate of my father in the many years in which they both worked as attending surgeons in the Methodist Episcopal Hospital for the up-lift and welfare of not only the surgical profession but of the profession in general and of humanity. I no doubt met the other gentlemen, but the names of those mentioned are those whom I still remember as to their characteristics. All these gentlemen were most kindly to a little boy who clung to his father's hand and who did not altogether like to be left alone in the company of the gruesome skeletons and anatomical preparations in huge glass containers which were everywhere in those dim lighted rooms of the old Brooklyn Surgical and Anatomical Club.

This Society was the forerunner of the Annals of Surgery. Dr. W. W. Keene, the noted Philadelphia Surgeon, for many years the Dean of American Surgery, speaking at the dinner celebrating Dr. Lewis Stephen Pilcher's fifty years in practice said of it:

"I never think of Pilcher but that two ideas are correlated with his name. One is Dr. George Ryerson Fowler, his surgical twin and the other is the Annals of Surgery, his surgical monument.

"The twins began to collaborate as early as 1878. They founded the Brooklyn Anatomical and Surgical Society with Pilcher as president and Fowler as secretary. In fact, it might almost be said

* Read before the Section on History of Medicine of the Medical Society of the County of Kings and Academy of Medicine of Brooklyn, April, 1942.

that they were 'the whole show,' for the twins did most of the work and wrote most of the early papers. When they had enrolled but twenty-five members they boldly launched the Annals of Anatomy and Surgery. The first volume consisted of only 102 pages and this represented the accumulation of two whole years, 1878–1879. But values does not depend upon bulk. This little book has two noteworthy papers, one on a complete 'Bifid Sternum' and the other is one of the early papers on a 'Cervical Rib.'

"I have always been glad that I helped them out with two papers in Vols. II and V.

"The next year, 1880, this rapidly growing infant had expanded into one good sized volume and from then on, but not for long, there were two volumes in every year. In January 1884, Vol. IX began bravely with its first number, but chill winter's blast was fatal. With this one gasp it gave up the ghost. As no postmortem was held I cannot give you the bibliographical cause of death.

"But like the fabled Phoenix from its ashes arose the Annals of Surgery. Instead of one volume for two years we have had year after year two impressive volumes of nearly 2,000 pages."

William J. Mayo said: "To you physicians of Brooklyn, I need not say how great has been the part played by Doctor Pilcher and also the late Doctor Fowler. The assistants of these men and others like them will dominate the next generation of American surgeons as the students of Billroth and Volkmann dominate the German school of today."

The minutes of these early meetings as well as subsequent ones will repay perusal by the student of surgery whether he be neophyte or master. They exemplify a type of master surgeon which may well be emulated.

The Medical School was incorporated October 17, 1879, under the direction of a board of trustees, consisting of Rev. James M. Buckley, D.D., Hon. John French, Joseph C. Hoagland, Esq., Hon. Darwin R. James, Hon. Geo. G. Reynolds, L.L.D., Francis S. Street, Esq., James H. Taft, Esq., and Hon. Stewart L. Woodford, some nationally and internationally famous, in addition to the members of the Council of the Society, for the purpose of securing to the Society a legal right to procure and use anatomical material, and to pursue its work of promoting the study of anatomy, surgery and pathology without interruption. In this school, demonstratorships of anatomy, histology, operative surgery and surgical pathology were established.

The first volume of the Annals of the Anatomical and Surgical Society, a handsome large octavo volume of 126 pages of closely printed matter bound in muslin, with gilt top and illustrated, privately printed, does not have any mention of who was editor. The second volume was edited by Charles Jewett, associated with E. S. Bunker, G. R. Fowler, L. S. Pilcher and F. W. Rockwell. The third and last volume was edited by Lewis S. Pilcher and George R. Fowler. This volume comprised the transactions of the Society from January to June, 1881, inclusive, and marked a further development of its work. From the modest beginnings of its first year followed the advance made in the second volume. The success of the latter stimulated another advance, the last issue being published January, 1884, later to become, in January, 1885, the Annals of Surgery, of which Lewis Stephen Pilcher was editor until his decease many years later and which is still edited by his son James Taft Pilcher.

We have seen how the Brooklyn Anatomical and Surgical Club developed into the Brooklyn Anatomical and Surgical Society and how its transactions became later the Annals of Surgery. From the same source sprang the Brooklyn Surgical Society which was organized November 2, 1887, at an informal meeting of:

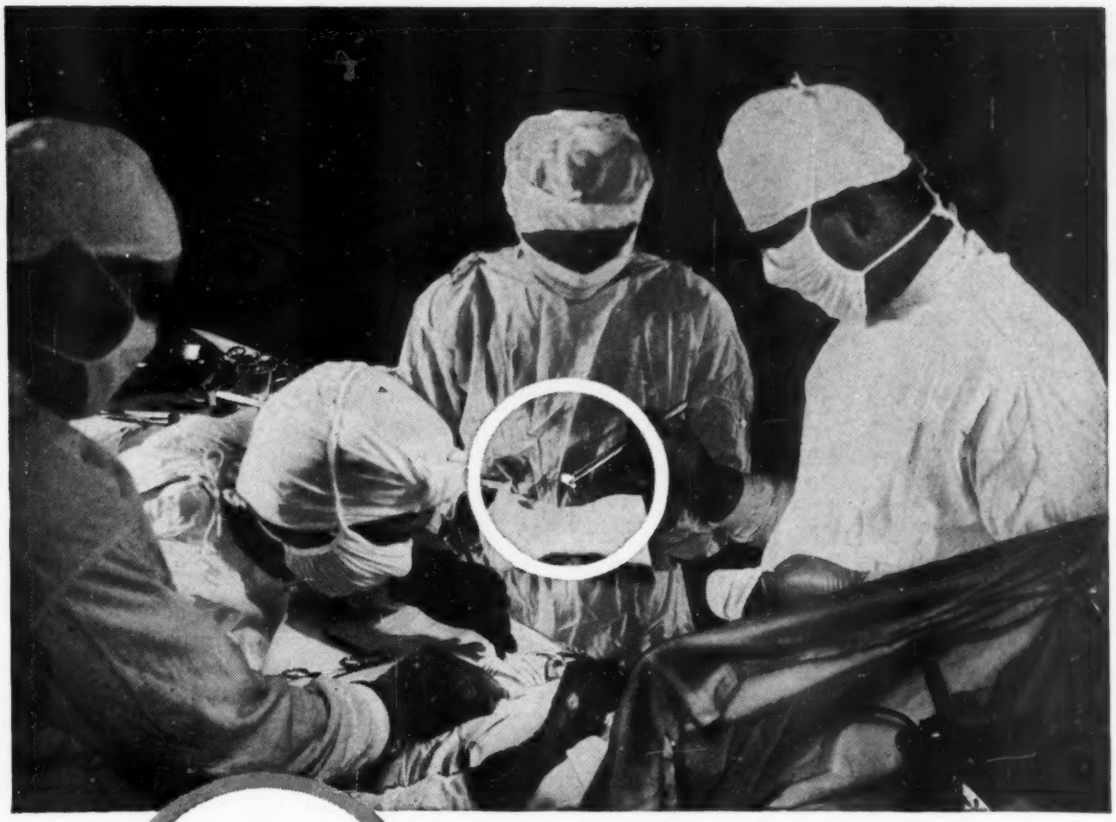
*Dr. Fowler, representing St. Mary's Hospital
Dr. Feeley, representing St. Catherine's Hospital
*Dr. Pilcher, representing M.E. Hospital
*Dr. Rockwell, representing St. John's Hospital
Dr. Wight, representing L.I. College Hospital
Dr. Thallon

A letter from Dr. Wunderlich (representing St. Peter's Hospital) warmly endorsing the proposed movement was read. Dr. J. D. Rushmore (City Hospital) and Dr. P. L. Schenck (Kings County Hospital) also sent letters in sympathy with the movement but not committing themselves to take part in it.

After some informal discussion it was resolved on motion of Dr. Fowler to form the Brooklyn Surgical Society, the gentlemen present and Dr. Wunderlich being the founders.

* Original incorporators of The Brooklyn Anatomical and Surgical Society.

GRANTS for medical research totaling about $150,000 have been awarded The George Washington University Medical School which this year is operating the largest research program in the history of the 121 year old institution.



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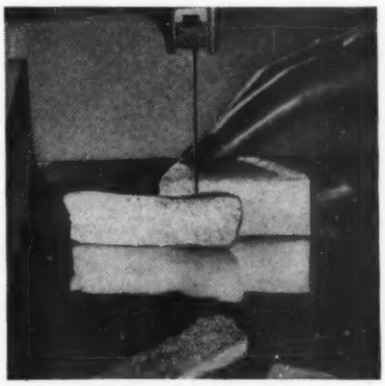

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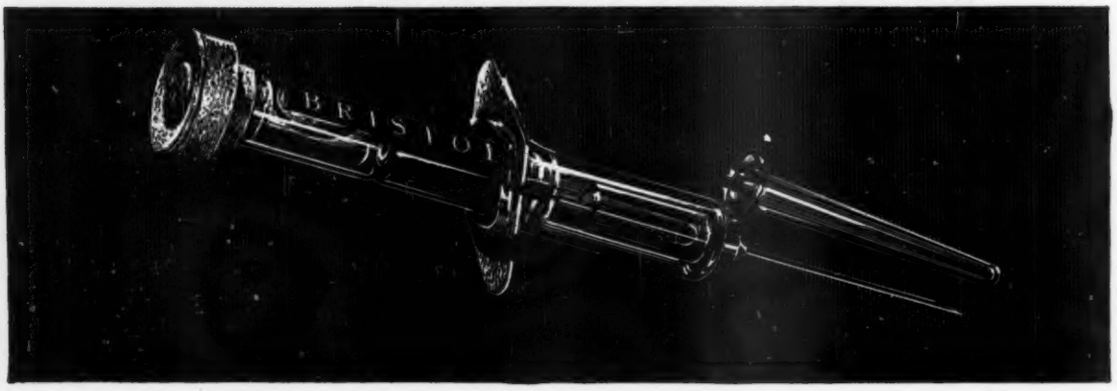

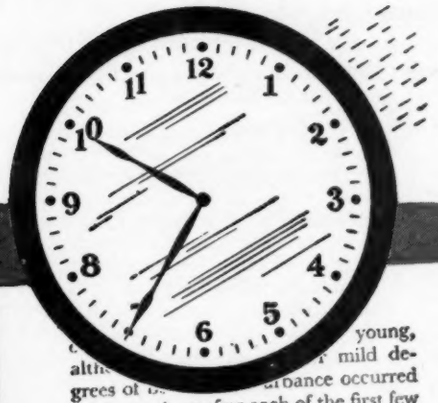

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In clinical use, 'Metycaine' has been compared mainly with procaine, since the latter has long been considered the standard for such comparisons. 'Metycaine' is about a third more potent than procaine, so that it can generally be used in three-fourths the quantity of the latter.[10] 'Metycaine' has in general a quicker but more prolonged action than procaine.[11,12,13] It is more certain in its effect, and it is clinically no more toxic.[12,13,14,15,16] Individuals who may be hypersensitive to procaine will tolerate 'Metycaine.'[11,12]

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Clinical Reports—'Metycaine' produces a prompt and deep spinal anesthesia.[14,15,16] [illegible][14] in a study of 1,500 spinal anesthesias, found that anesthesia outlasted the operation in the following percentage of cases, provided the dose of 'Metycaine' was 100 mg. or more:

Duration of operation	Anesthesia outlasted operation in
60 minutes	100%
75 minutes	93%
90 minutes	74%
105 minutes	38%
120 minutes	9%

This duration of anesthesia was approximately 40 percent greater than that obtained with procaine administered by a similar technic. [illegible] found the extra twenty or thirty minutes of anesthesia provided by 'Metycaine' extremely helpful in such operations as cholecystectomy with choledochostomy, and perineal repair with hysterectomy. Even when anesthesia was of insufficient duration, it wore off gradually, and general anesthesia could be induced without haste before the relaxation of spinal anesthesia disappeared. This was in contrast with [illegible]'s experience with procaine, with which agent muscular rigidity was found to return almost instantly with the return of sensation, causing embarrassment to both surgeon and anesthetist.

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Literature on 'Metycaine' (Gamma-[2-methyl-piperidino]-propyl Benzoate Hydrochloride, Lilly) will be supplied to physicians upon request.

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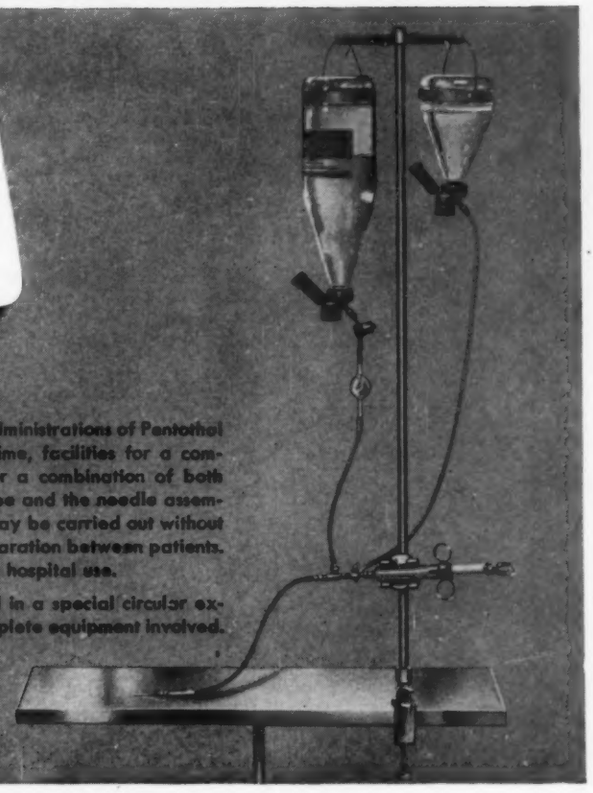

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ADVERTISERS INDEX

Instruments and Apparatus

A. S. Aloe Company 39
American Cystoscope Makers, Inc. 15
American Sterilizer Company ..... *June*
Austenal Laboratories, Inc. ..... *June*
Bard-Parker Co., Inc. ..... *June*
Becton, Dickinson & Co. ..... *June*
Gomco Surgical Mfg. Co. ..... *June*
J. E. Hanger, Inc. 41
Fred Haslam & Co. 1
The Kansas City Assemblage Co. ..... *June*
Kny-Scheerer Corp. ..... *June*
Parker, White & Heyl, Inc. ..... *June*
Geo. P. Pilling & Son Co. 9
Propper Manufacturing Co. 39
Singer Sewing Machine Company ..... *June*
J. Sklar Manufacturing Co. ..... *June*
Wallace Orthopedic Supply Co. 11
Edward Weck & Co., Inc. 13

Sutures

The Armour Laboratories 16
Bauer & Black 6–7
Davis & Geck, Inc. ..... *Insert Facing 2nd Cover*
J. A. Deknatel & Sons, Inc. 41
Ethicon Suture Laboratories ..... 10, *Insert Facing p. 32*
Gudebrod Brothers Silk Co. ..... *June*

Pharmaceuticals

Abbott Laboratories 26
American Hospital Supply Corp. 8
The Arlington Chemical Company ..... *June*
The Armour Laboratories 16
Baxter Laboratories 8
Bristol Laboratories 36
Bristol-Myers Company 42
Ciba Pharmaceutical Products, Inc. ..... 23, *Back Cover*
Commercial Solvents Corporation ..... *June*
Cutter Laboratories 20, 33
International Pharmaceutical Corp. 17
Iodine Educational Bureau, Inc. 44
Lanteen Medical Laboratories, Inc. 43
The Lavoris Company 44
Eli Lilly and Company 37
The S. E. Massengill Company 22
Merck & Company 30
McNeil Laboratories, Inc. 35
The National Drug Co. 32
Nutrition Research Laboratories 18–19
Ortho Pharm. Corp. 46
Parke, Davis & Co. 29
Reese-Davis Drugs, Inc. ..... *June*
J. B. Roerig & Company ..... *June*
Rystan Company ..... *June*
Schering Corporation 31
Sharp & Dohme, Inc. 21
E. R. Squibb & Sons ..... *June*
Frederick Stearns & Company 25
The Upjohn Company 24
Wallace Laboratories, Inc. ..... *June*
Wm. R. Warner & Co., Inc. 27
White Laboratories, Inc. ..... *June*
Winthrop Chemical Co., Inc. 2

Hospital Supplies

A. S. Aloe Company 39
American Hospital Supply Corp. 8
Becton, Dickinson & Co. ..... *June*
Cutter Laboratories 20, 33
Fred Haslam & Co., Inc. 1
Johnson & Johnson 28
Macalaster Bicknell Company 14
Mallinckrodt Chemical Works ..... *June*
Owens-Corning Fiberglas Corp. 12
The Pioneer Rubber Co. 40
J. Skar Manufacturing Co. ..... *June*

Books & Magazines

Washington Institute of Medicine 5

Post-Graduate Instruction

Cook County Grad. Sch. of Med. 38
N. Y. Polyclinic Med. School 38

Foods

American Meat Institute ..... *June*
Cereal Institute Inc. ..... *June*
National Confectioners Assn. ..... *June*
The Wander Company 45

Miscellaneous

U. S. Treasury 34

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